THE TELEGRAPHIC JOURNAL AND

# Electrical Review.

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## ELECTRICITY AND GAS.

ON the respective dates of May 29th and June 1st, Messrs. M'Hardy and Crookes forwarded long and interesting letters to the *Times* on the above subject. We reproduce these in our other columns. It will be seen that we are gradually arriving at a clearer understanding as to the relative cost of the rival systems, and the advantage to be derived, from every point of view, by the use of electricity as a lighting agent, is becoming more and more apparent. If Mr. Crookes finds it economical to use the incandescent electric lamp for his private residence, heavily handicapped as he is with difficulties placed in his way, how much more economical will it be than gas at its present price when we have central works for supplying whole districts. That this will soon be accomplished we cannot doubt, and most of the principal witnesses examined before the Electric Lighting Committee declared that the only thing now required to enable the electric light to compete on favourable terms with gas, was the permanent establishment of central stations. Regarding the production of the current for electric lighting purposes we quite agree with Dr. Siemens when speaking of dynamo-electric machines: they are so good that it does not appear likely that any particular improvement can be made in them so as to effect more economically the conversion of mechanical into electrical energy, which Dr. Siemens says can now be performed with a loss of only 10 per cent.; their construction, however, may be modified and simplified, and their cost considerably reduced. Doubtless the attention of inventors would be better directed towards the perfecting of incandescent lamps, than in probably vain endeavours to produce better machines. We do not now, nor did we ever, believe that the consumption of gas would be reduced by the general adoption of the electric light, and we have every faith in the manifold uses to which gas may be put beyond those at present existing. In a former number of the ELECTRICAL REVIEW we expressed a wish that we might shortly be enabled to arrive at that point of illumination where the costs of the two systems would be practically the same.

It has of course been long known that much more light could be produced from the energy contained in, say, 1,000 cubic feet of gas, by employing it as the driving power for a dynamo-electric machine, than by consuming it for direct lighting; and this favourable result can be obtained not merely by the employment of arc lamps, but also in a smaller degree by those of the incandescence type, giving each about 16 candle-power. If we allow 20 cubic feet per hour per horse-power—a very liberal margin for the "Otto" gas-engines of Messrs. Crossley Bros., when working under the best conditions—we should obtain from 1,000 cubic feet of gas 50 horse-power. One horse-power of energy will give us at the lowest estimate eight lamps of 16 candle-power each, or say, 130 candle-power per horse-power, the total amount of light, therefore, being $130 \times 50 = 6{,}500$ candles. Taking now the most favourable view of gas and allowing 5 cubic feet per hour for a 12 to 15 candle-power light, we have the total result of 2,400 to 3,000 candles. Therefore the incandescent electric light gives more than double the total illuminating power of gas, for a given quantity consumed, for producing lights of almost identical candle-power; or, in other words, the *ordinary* gas lighting of streets costs more than double that of the electric light when used for the same purpose and under similar conditions. According to the calculations of Mr. M'Hardy, the cost of gas *v.* electricity under such conditions as those above described is more than three times in favour of the electric light. We think, however, that his figures are incorrect as to the light emitted by an ordinary gas burner, the consumption of 5 to 8 cubic feet producing only 6 to 8 candle-power being altogether erroneous. However, the experiment of Mr. Crookes with all its adverse circumstances, shows that the consumption of 550 cubic feet of gas in his engine gives him a total light of 440 candles for five hours, whilst to get anything like an approach to this result by using the gas direct for illumination would necessitate the consumption of 750 cubic feet in the same time.

It follows from the figures we have given that at any stated candle-power the electric light should be cheaper than gas; but at present there remains a considerable gap between electric lighting by the incandescence and arc systems, and it is between these two points that gas has the advantage. We cannot safely work an incandescent lamp as high as 50 candle-power, and we cannot well reduce the arc lights below 400 candles or so. On the other hand, gas can be regulated to any desired intensity from one candle to 1,000 or more. Again, if we wish to lower the illuminating power of electric lamps it is generally effected by the insertion of some artificial resistance, but then we consume just as much power as if we were working up to the normal strength of our lights. The consumption of gas, however, is more in accordance with the illuminating power produced. It rests with electrical engineers to fill the gap at present existing between the maximum candle-power of an incandescent lamp which can be employed with safety, and the minimum light which is now produced by arc lamps. Of course, a number of the present incandescent lamps might be placed in one globe, so as to produce a light of 50, 100, or 400 candle-power, but this would not be an economical way of competing with gas; for it will be seen that according to Mr. M'Hardy's figures, in reference to the Siemens regenerative gas burner, that 55 cubic feet of gas consumed in an hour yields an illuminating power of 330 candles, or that the same volume of gas utilised in a gas engine for driving a dynamo-electric machine would produce about 360 candle-power, or but slightly in favour of lighting by electric incandescence with the present form of lamps. However, we think that the view is gradually gaining ground that gas might very well be left to itself for street lighting, and that the proper domain for the incandescent electric light is in-doors. No one but an enthusiast could say that the Edison system on the Holborn Viaduct approaches in any way our prior expectations, and at the same time no one can deny that the finest specimen of street lighting in London is to be found in the continuation of the same street, viz., the Siemens regenerative gas burner in Holborn, extending from Hatton Garden to Gray's Inn Road.

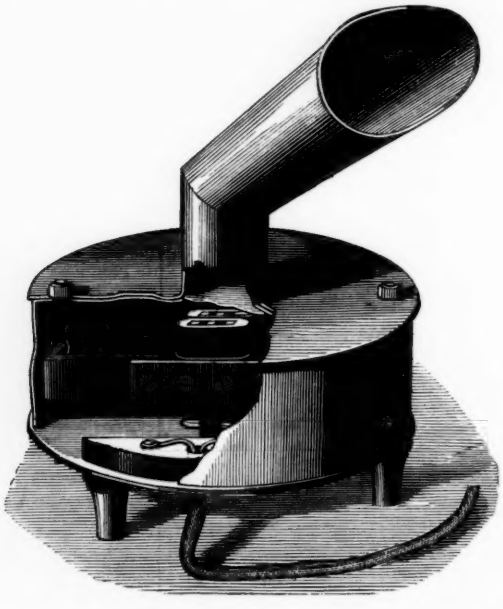
## BÖTTCHER'S TELEPHONE.

IN a former number of the ELECTRICAL REVIEW we published a short note describing this telephone, and we now extract from our esteemed contemporary, *L'Electricien*, a longer and illustrated account of the same instrument. This telephone differs from the systems known at present, in that the magnet, instead of being fixed in the case, as it generally is, is held suspended in it by means of screws and steel wires. By this means the magnet can participate, within certain limits, in the vibrations of the membrane, but in an opposite direction.

The apparatus shown in the diagram consists of a cylindrical copper box, 14 centimetres in diameter and 5 centimetres high, in which the different parts are inclosed, and which is shut by a lid with a hole in the middle. To this lid and to the right of the opening is fixed a mouthpiece into which one speaks. The sounds emitted strike against a vibrating plate screwed into the lid, the vibrations of which influence the magnetism of a magnet suspended to the sides of the box by three steel wires, the tension of which can be regulated at will. The armatures on which the induction coils are fixed are not solid pieces of iron; they consist of three little slips of iron placed at a little distance from each other. Owing to this arrangement the variations of magnetism act upon them more easily and promptly.

The openings made in the circle of brass enable us to insure the exactness of the distance between the membrane and the armatures. If it is greater or less than half a millimetre, it is rectified by means of screws above or below, by means of which the magnet is brought towards the membrane or drawn away from it. The telephones are composed entirely of metal, so that when once regulated, they require no further attention.

The plan of the system is easily understood. The magnet, owing to the elasticity of the wires, being able to oscillate slightly in unison with the vibrations of the plate, as soon as the latter approaches it, as the magnetic action increases in proportion to the square of the distance, the amplitude of the oscillation increases until the tension of the wires on the one hand, and the elasticity of the plate on the other,



come into equilibrium with the attraction. On the contrary, as soon as the plate goes back the tension of the wires brings back the magnet, and demagnetisation takes place much more rapidly. By this method, therefore, we succeed in increasing the variations of magnetism in the magnet, and consequently, if we imagine a wire coiled round the poles of this magnet, much more forcible induction currents are produced.

The best results are obtained by bringing the mouth as near as possible to the mouthpiece, in order to speak; whereas for hearing, it is not necessary to stand so close. In a quiet place the receiver is heard at a distance of 1 metre, and even more.

In ordinary cases a simple call or the sounding of a little trumpet is sufficient for a signal, as with the Gower telephone. In noisy places it will be advantageous to employ a hand telephone (Bell's model) as receiver, and a Böttcher telephone as transmitter. At each station the two telephones are placed in the same circuit.

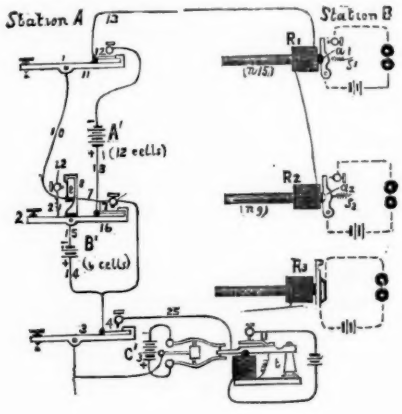
The hand telephone, on account of its shape and its lightness, is very easily managed. The ear-piece is at right angles to the magnet, which serves as a handle, and in order to hold it to the ear it is not necessary, as with the other telephones, to raise the arm and hold it away from the body.

We have here, therefore, a portable telephone, little likely to get out of order, leaving far behind it the Gower and other similar systems, and which, if employed where rapid communication is necessary, such as in the army, in mines, &c., is calculated to give the best results.

## FIELD'S SEXTUPLEX TELEGRAPH.

IN all multiple telegraphs designed to transmit more than one message from one station, such as duplex, triplex, &c., there have occurred serious difficulties at the receiving station, due to interference of the local connections, unless the respective receivers were locally disconnected.

Mr. Edison discovered this difficulty in the quadruplex, and overcame it by operating one receiver by changing the direction, and the other by changing the strength, of the currents, there being no local connections whatever. But the problem becomes somewhat more complicated when an additional transmitter and receiver are added; and, until very recently, this problem has not been satisfactorily settled. In the accompanying diagram is seen a sextuplex, invented by Mr. Stephen D. Field, of N. Y., which is simple in its nature, and no doubt capable of transmitting accurately six messages, three from each end, at one and the




same time when differentiated. At station A are shown three transmitting keys, two of which (1 and 2) transmit currents differing in strength; and a third, 3, adapted to transmit vibrating or reed impulses from a constantly vibrating reed transmitter, U.

At the receiving station are three totally independent receiving relays: $R^1$, $R^2$, $R^3$, adapted to receive each an independent message from the keys 1, 2, and 3, respectively. In relays $R^1$ and $R^2$ are cores, which are permanently magnetic, the former having a magnetic strength of + 15, and the latter of + 9. $R^3$ is a reed receiver of well-known form, and responds only to reed vibrations from transmitter 3. The operation is as follows: Normally there is no current on line, and all of the local currents at station B are open. When key 1 is closed a current of — 18 is put on line from batteries $A^1$ and $B^1$, sufficient to overpower the

permanent magnet + 15 in $R^1$ by a balance of — 3; but $A^1$ will not be held up by such a power, the spring $S^1$ being adjusted to withdraw it from all powers of + 3 or less.

This power of — 18 overpowers permanent magnet of + 9 in $R^2$, but with a balance of — 9, and as $S^2$ is also adjusted for all powers of + 3 or less it will not fall back.

$R^3$ only responds to key 3 and reed impulses, hence $R^1$ only responds.

If key 2 alone is closed a current of — 6 from battery $B^1$ is sent to line.

This leaves a balance of + 9 in the permanent magnetism 15 of $R^1$, and A does not respond, but in relay $R^2$ a balance of + 3 results and the local responds.

As before stated, when key 3 is closed reed impulses alone are sent, and $R^3$ alone responds, and under all conditions regardless of the position of keys 1 and 2.

If keys 1 and 2 are both closed simultaneously a current of — 12 is sent to line, which leaves a balance of + 3 in $R^1$ and — 3 in $R^2$, and both relays respond.

## SELF-GENERATING ELECTRICITY.

ONE of the latest additions to the extraordinary number of new companies recently organised for the production and supply of electricity for lighting purposes is that styled the "Self-Generating Electric Light and Power Company, Limited." According to the prospectus,

This company is formed in the first place, to supply a want which becomes more felt and more apparent with every advance made in electric lighting, that is, the supplying of factories, mills, workshops, public buildings, whether large or small, and private houses, with self-generating electric light and electric power; and in the second place to acquire the invention of Mr. R. H. Simons, for the production of electricity by the self-generating process, and for his special incandescent lamp, and the letters-patent for the same. A petition has already been presented for the grant of her Majesty's Letters-Patent for this invention, and the provisional specification has been filed. The company purposes to manufacture and sell electrical apparatus.

The company purposes to supply the self-generated electricity to any machine or engine which has been invented for supplying motive power for any purpose, and to adopt the same electrical plant for the double purpose of lighting and power, either alternately or in combination, for which purposes Simons' invention is confidently believed to be the best.

Believing as we do in the great future of electric lighting by incandescence, and being always desirous of furthering its interests by every means in our power, we took an opportunity of calling at the offices of the above company, in order to gain additional information concerning the attractive (to the public) announcements contained in the company's prospectus. There are now a considerable number of lamps of the incandescence type in operation, and we would gladly welcome any new system which can compete favourably with those at present in use. The Self-Generating Electric Light Company purposes to introduce the Simons incandescent lamp,

With which the *softness and intensity* of the light is so easily regulated that the advantages cannot be over-estimated. Intending investors can satisfy themselves upon these points by an inspection of the light, which may be seen at the company's offices, and at the Royal Exchange, Leeds.

The Simons incandescent lamp claims superiority over every other in respect of simplicity, cost of manufacture, economy in the use of carbon, saving of trouble, and waste in frequent changes, and the minimum of liability to get out of order.

The vendor estimates that the cost of complete sets of electrical apparatus, wires and lamps, will be much less than the cost of meter, pipes, and fittings for gas, and the annual saving, for equal candle-power, will be from 40 to 50 per cent. in favour of electricity.

Then again, according to the ideas of the directors of this company,

The supply of electricity by the self-generating system has the double advantage of being independent of any complicated machinery, and each separate establishment being also independent of every other.

Returning to our inquiries, which were addressed to the secretary. We were first of all treated to a short preamble, the gist of which may be gathered from the extracts we have given from the company's prospectus. Concerning the self-generating process, we were shown a single Bunsen cell, which, together with a Swan lamp, constituted the total effects of the office visible to us with respect to the objects of the company. We were informed that the electricity was self-generated by a number of these cells, which might be placed in the coal-cellar or any convenient place. The single element brought before our notice had been, so it was stated, in use for fourteen months, and the zinc plate was then only partially consumed. We gathered that Mr. Simons had discovered a powder which, when added to the solution of these batteries about every three months, effectually preserved the zinc. It is not necessary that we should make any remarks regarding the impossible results of this secret powder, nor need we scarcely remind the public that Bunsen cells can be used by any one who likes to fit up a costly generator of electricity for lighting purposes. Our next questions were upon the new lamps of Mr. Simons; and we were told that owing to the present great development of electric light companies, Mr. Simons had necessarily to bring out his company before he was actually ready. He was, however, actively engaged in completing his patents. Therefore, in the meantime, Swan lamps are employed to exhibit another man's (Bunsen's!) invention. Mr. Swan probably never imagined to what queer uses his great labours would be turned; but he has now the satisfaction of knowing that he is not only a benefactor to the public at large, but also that his inventions are calmly employed for the purpose of floating a company for a rival system which will, doubtless, still further add to the public benefit.

The cost of this convenient system is, we understand, about £2 per lamp for fitting up, and the cost for working lamps afterwards about 3d. per week each, or 10 lamps of 10 candle-power each would cost 2s. 6d. per week for the ordinary evening's lighting. The number of cells required to light up a house would, of course, depend, so the secretary assured us, on the number of lamps one might wish to employ. We were not told how often it would be necessary to change the liquids in the cells, or any such minor details as that.

One word, as to the price required for a generator of electricity which every person is at liberty to use, and for a lamp which as yet, we were informed, has no actual existence.

The only contract entered into is dated the 26th May, 1882, made between R. H. Simons of the one part, and James Farie on behalf of the company of the other part; the consideration payable to the vendor is the sum of £120,000, £80,000 in cash, and £40,000 in fully paid-up shares, and one-third of the proceeds of the sale of all concessions and foreign patents. The directors retaining the right, if they so think fit, to pay the whole of the £120,000 in cash, in lieu of any portion in shares.

The satire contained in the last sentence is admirable. Although the ostensible objects of the company are those which we have set forth, we find that they have some twenty-five other objects, a few of which are worthy of reproduction.

(*h*) To acquire, carry on, *or at any time to cease to carry on* (!!!) either in the United Kingdom or abroad, the business of manufacturers of electrical generators or accumulators, lamps of all kinds, and all fittings connected therewith, including lamp posts or electric light elevators, carbons, electric motive, gas, water, steam or other engines, turbine or other water-wheels, and all or any kind of electrical apparatus and appliances, whether used, or which may hereafter be used, in connection with electric lighting, electro-plating, electro-deposition, electromotive force, lightning conductors, or otherwise, used in connection with electro force for any purpose, and whether in connection with any invention now known or hereafter to be discovered. Also to acquire by purchase, lease, or otherwise, any lands, buildings, and hereditaments of any tenure, whether in the United Kingdom or elsewhere, suitable or convenient to be held, used or occupied, for the purpose of the company.

(*f*) *To borrow or raise money* by the issue of, or upon bonds, debentures payable to bearer or otherwise, bills of exchange, promissory notes, or other obligations, or securities of the company, or by mortgage, or charge of all or any part of the property of the company, or of its uncalled capital, or in such other manner as the company shall think fit.

(*i*) To manufacture *bricks, quarry stone, manufacture of cement* and *concrete*, and to construct tunnels, or subways, for carrying wires or other conductors of electricity, and to construct *railways, tramways*, or *waterways*.

(*j*) To acquire the right to use or manufacture, and put up either in the United Kingdom or abroad, telephones, telegraphs, phonographs, and all electrical apparatus now known or that may be hereafter invented, including all wires or appliances for connecting electric apparatus at a distance, with other electric apparatus, and including the formation of electric exchanges or centres.

(*k*) To form centres at which electric power may be generated or accumulated, and from which the same may be distributed for telephonic purposes, or for the purposes of street lighting or the lighting of public spaces or buildings, factories, works, railway stations, churches, chapels, shops, ships, harbours, houses, or elsewhere; or for the purpose of giving motive or heating power in all or any of the beforementioned places, or elsewhere; for electro-plating, electro-deposition, or for any purposes whatsoever, now known or that may be hereafter discovered.

(*l*) To let out on hire all or any part of the property of the company (whether real or personal), including every description of apparatus or appliances of the company, by the hour, day, week, month, or term of years.

(*m*) To contract to do as agents for others all or any of the work which the company can do for themselves.

(*n*) To enter into contracts, for any period, to supply electricity as a transmitter of motive power, or to supply or maintain all electric generators, lamps, engines, motors, or other electrical appliances of any kind whatsoever, now known or hereafter invented.

(*o*) To conduct the business of manufacturers of, or dealers in glass, india-rubber, vulcanite, iron, copper, or other metals, electrical conductors, or non-conductors.

(*p*) To carry on the business of wire drawers, wire insulators or coverers (*sic.*), and general manufacturers of every description of insulator or conductor, and of any article or thing used in connection with all or any of the articles authorised to be manufactured or dealt in by this memorandum of association.

(*q*) *To train and supply consulting and other electricians*, engineers, skilled workmen, or labour, for the purpose of carrying out any works for others, which the company could do, or carry out for themselves.

We may mention that the Consulting Electrician of this Company is P. W. Seymour, Esq., *Medical Electrician of Guy's Hospital*, and the Electrical Engineer, R. H. Simons, Esq.

We have considered it necessary to call attention to this matter in the interests of those genuinely working on the subject of electric lighting, and we shall continue to notice any such attempts at misleading the public in the future. If the company could by any possible means act as manufacturers of all electrical apparatus *now known or hereafter to be invented*, well and good; but to pay £120,000 out of a capital of £300,000 for the invention of Mr. Simons, as we understand it, is a matter on which it is impossible to keep silent.

## THE PRINCIPLE OF CARBON TELEPHONES.

[Through the courtesy of M. Th. du Moncel, who sent us advanced proofs of the above interesting article, we are enabled to present it to our readers in its entirety. It is also to be found in *La Lumière Electrique* of the 3rd inst.]

THE lawsuits which have recently taken place in England, regarding the patents for telephones taken out by Messrs. Bell and Edison, now combined for mutual benefit, have led to several interesting discussions on the questions relating to the principles on which this apparatus is founded, and the result is, according to the last judgment pronounced, that the telephonic receivers based on the action of undulatory currents are Mr. Bell's property, but that the transmitters with variable solid resistance of the Edison type, are public property, and consequently that all the microphonic transmitters of carbon, coke-powder, &c., are not infringements.

It is certain that the principle on which the action of these instruments is based has long been known, for since 1856 I had made several experiments in order to demonstrate it, but according to the French law this priority would not have been sufficient to invalidate the Edison patent, for, by this law the application of a known method to an apparatus producing a new effect can be patented. However, it would seem that, even from this point of view, Edison would not have the priority, for in 1876 (April 10), Mr. McDonough had, it is said, made a transmitter with variable resistance which, when applied to an electro-magnetic telephone, was capable of reproducing speech, and this system and that of Edison only differed in the material employed for the contacts. In the one, in fact, the contact is effected between a surface of carbon and a surface of platinum, whereas in the other it takes place between two pieces of metal with rough surfaces, placed one upon another, the widest of which is connected with a diaphragm stretched upon a drumhead. In the latter system, we can imagine that it is the rough surface which takes the place of the imperfect conductor represented in the other by the carbon.

It has been shown elsewhere that the presence of a diaphragm vibrating before the imperfect contact was not necessary for the transmission of speech, since this effect could be obtained by speaking over an agglomeration of fragments of carbon placed between two metallic electrodes. It should be remembered, in fact, that with a system of this kind, I was able to dispense with a battery by employing as electrodes zinc and copper plates, and by immersing in water these carbons and electrodes. All these systems are, in fact, derived from the principle which I discovered in 1856, and as, notwithstanding what has been said on the subject by competent men, my researches seem to have been forgotten, I think it advisable to refer briefly in this article, especially as in a report recently presented to the Society of Telegraph Engineers of London by Mr. Dolbear, we read the following remarks, which require some comment, on the subject of the interrupter of Reiss's telephonic transmitter:—

"It is *denied* that, at the time when Reiss invented his transmitter, it was known that differences of pressure imparted to the contacts of an interrupter would produce differences in the intensity of the electric current passing through them. However, all that have employed voltaic batteries since they have been known, are aware that the first instructions given were to establish the communications well; and why? For this simple reason, that if these communications were not good, the maximum of current that they were capable of producing could not be obtained. Thus, good contacts were then known as good elements for an electric current, &c."

Mr. Dolbear must have forgotten the earlier construction of Reiss's apparatus, and lost sight of the principle of the telephonic transmitters with voltaic currents, when he wrote the above lines. Of course it was known before 1860 that contacts well established offered less resistance to the current than contacts badly made, but that was owing chiefly to the state of cleanliness of the surfaces of these contacts; the question of pressure did not enter into it, seeing that the differences which might result from this action with metallic contacts are only manifested in the case of extremely weak contacts. Now, in the preparation of a battery, no one has ever had the idea of effecting the communications by the simple adherence of one conductor to the other; connecting screws or straps have always been used, and then a pressure, more or less, did not matter. But what was attempted above all was to well scrape the surfaces of contact, so as not to have a layer of oxide or greasy matter which might introduce into the circuit a useless resistance. When, in 1856, I studied effects of this nature, I had not taken into account this layer of more or less resistance, since *I only used metals perfectly scraped and dried*, and what struck me was, that in the slight contacts resulting from the simple adherence of two pieces of metal placed one upon the other, the intensity of the current increased up to a certain limit with the pressure exercised on them. This is what made me write in vol. i. of the 2nd edition of my "Exposé des Applications de l'Electricité," page 246 (published in 1856), the following remarks:—"A curious fact, and one which seems at first to be contradictory to the theory which has been formed of electricity is, that *the pressure, more or less, which is imparted between the contacts of the interrupters has considerable influence on the intensity of the currents which pass through them.* This is owing to the fact that the metals are not always in a perfect state of cleanliness at the point of contact, but, perhaps, also *to a physical cause not as yet well understood.*"

It is certain that this observation was published before Reiss's experiments, but I doubt whether he took it into account in his musical telephone, for in this apparatus the two contacts of the interrupter, in order to produce an appreciable effect, should not be permanently touching. We know, in fact, that in order to cause sounds to be emitted in an iron wire coiled in a spiral, it was necessary, in the conditions in which Reiss was placed, that *the currents should be freely interrupted;* with mere undulatory currents transmitted by our most perfect microphones, articulate sounds can only be perceived in receivers of this kind by applying the receiver to the ear. Now, Reiss's apparatus had never been constructed for that. On the other hand, with metals, the extent of the variations of electric intensity with the

differences of pressure is so limited that, even with very delicate receivers, the reproduction of speech would never have been effected in a satisfactory manner; it would have been necessary, therefore, to render the surfaces of contact rough, as Mr. McDonough has done, or to insert between the contact plates a drop of water, or a body of moderate conductivity, as Mr. Yeates had done. Even although Reiss had spoken of transmission of speech by his system, that would not prove much, for M. Bourseul had also claimed to have effected it in 1854 by similar methods, and these means were evidently insufficient.

Thus the fundamental principle of the speaking telephone, *i.e.*, the possibility of affecting a telephone receiver by undulatory currents, the function of the amplitudes of the sonorous vibrations, cannot be discovered in Reiss's telephone, which has, besides, never transmitted anything but musical melodies; and, whatever Mr. Dolbear may say, this system must be actuated by currents completely interrupted in order to work as Mr. Reiss intended, *i.e.*, so as to produce strong sounds, just as the singing condenser can only be heard at a distance under similar conditions.

We shall speak later on of the other methods of arrangement attributed to Reiss by Mr. Dolbear, but these have nothing to do with our subject at present.

At the time of my first experiments on imperfect contacts, I had tried, as interrupters, various conducting bodies beside metals, even carbons, and I thought I had discovered that *the differences of intensity increased with the resistance of the bodies in contact.* This fact was proved to me afterwards, when I noted the variations of resistance produced by powdered charcoal and coke, according to their degree of compression. However, not seeing at that time any particular advantage in this property, I gave it no further consideration, and only thought of utilising the carbon interrupters to obtain undulatory currents capable of reducing the effects of extra currents. In the volume before quoted (vol. i., pp. 263, 264) I have described two systems of interrupters of this kind, one of which was designed by Pulvermacher. In 1872, when I commenced my studies of the conductivity of semi-conductors, I was led to measure the resistances of charcoal-dust and metallic filings, and this is what I said in one of my notes inserted in *Comptes Rendus*, December 2nd, 1872 :—

"The value of the resistance of the intermediate substance was, with the dry charcoal powder, from 1,200 to 2,000 kilometres of telegraphic wire, and with the metal filings or coke-powder from 1,200 to 2,000 metres, according to the greater or less brilliancy of the surface of the metallic grains *and their degree of compression round the electrodes, &c.*" The effects of slight connection between the contacts of the interrupters had particularly struck me in 1864, when I experimented on M. Carlier's electro-magnets with naked wire. On coiling round a tube of glass, by the ordinary process, a spiral of copper wire unprovided with any insulating covering, I was surprised to find that my spiral offered, along one single row of spirals, almost as much resistance as a spiral of the same length of wire covered with silk, although my wire was perfectly clean. Thinking that this effect was attributable to an insufficiency of contact between the spirals, I wished to become sure, and therefore adjusted at the extremities of my tube two slips of wood, which I made to slide along it by means of a screw-handle crossing the tube lengthways. In this way by making the slips approach one another, I was able to compress the spirals one against another in succession and thus increase their adherence. Under these conditions, the closer the contact between the coils, the more easily would the current passing through the spirals be derived from the metallic mass formed by the juxtaposition of these spirals, and consequently the resistance would be diminished in proportion to the tightness of the coiling. This was verified by the experiment, and I could also see that the effect was all the more marked when the number of spirals or contacts was greater and when the wire was not so well cleaned. When the pressure was very slight, as in ordinary coils, the resistance of the wire was almost as great as if it had been covered with silk, but it grew less and less as the screws were tightened until the maximum pressure was attained. The reverse took place when the screws were loosened. I made this experiment in 1864, when I presented to the academy M. Carlier's electro-magnets, but in 1865, I published a long article on the subject in the *Annales Télégraphiques* (vol. viii., p. 211, published March-April, 1865), from which I give the following extract :—

"With coils of 186 spirals, the scouring of the wire with emery paper only, made the insulation vary in the proportion of 1·06, to 1·35; but under other conditions, for example, *when the wire is coiled on a glass tube and the spirals pressed together closely, this proportion is infinitely greater.* However it may be, when the contact between the spirals becomes perfect, no magnetic effect is produced. Thus an amalgamated wire coiled in a spiral produces no attraction, and if we envelop with a covering of tin-foil the coil of an electro-magnet with a single row of spirals, the attractive effects are considerably diminished.

"The result of all this is that the juxtaposition of the convolutions of a magnetic spiral *constitute an imperfect contact* which, as in the metallic filings, oppose to the propagation of electric currents a considerable resistance; but this resistance is not sufficient in itself to account for so complete an insulation of the spirals of the magnetising coil as we have found to take place. The proof is that *the contact of these spirals is sufficient to preserve almost without loss of force the action of the current when the wire of the magnetising coil has been cut at one or several points.*" M. Trève has demonstrated the variation of the intensity of a current in proportion to the pressure in a very interesting and unmistakable manner, by the following experiment :—

"It is known that if we break an electric current passing through an electro-magnet between its poles, we produce a rather loud noise capable of being heard in every part of a room. Now this noise can be rendered more or less intense according to the pressure exercised on the two conductors that are separated."

My researches on the effects produced by pressure have not been confined to metals and broken-up conducting substances; I have extended them to bodies of a woody nature; and this is what I said on the subject in a note presented to the Academy of Sciences at the sitting of July 6th, 1874 :—

"The degree of pressure against the wood, of the plates of platinum serving as electrodes, so influenced the intensity of the current thus transmitted, that having amounted to 12 degrees with a maximum pressure, it fell to zero when the plate was left to its own weight, and to 5 degrees only with a slight pressure. We find from these first experiments that the relative conductivity of the wood is due in a great measure to the dampness absorbed through its pores, and that this conductivity is in proportion to the degree of pressure of the communicating plates. This last action then evidently depends *on the closeness of the contact* produced between the two adjoining surfaces, for by substituting a drop of distilled water for the pressure, we immediately obtain, with the plates simply laid upon the wood, the maximum of the deviation, just as if these plates had been pressed tightly down.

I describe still further experiments relating to these effects of pressure in several reports presented to the Academy at the sittings of August 10th, and September 7th, 1874, and May 2nd, 1875. This resistance to the passage of the current of which I have just spoken, is not confined to electrical transmissions; it is also to be found in magnetic effects. Thus, if we divide a magnetic core into several parts, or if we form it of several plates of iron in juxtaposition, the attractive force which it will produce will be less energetic, but the inductive effects will be much more intense, on account of the greater rapidity of the magnetisations and demagnetisations. Now this effect will be about the same whether the plates are magnetically insulated from each other or not, if they are not too closely pressed together. This explains why it is not necessary in induction coils to insulate the different iron wires which compose the magnetic core. I have described these effects at some length in my "Exposé des Applications de l'Electricité" (vol. v., pp. 347, 348, 349).

The explanation of the increase in proportion to the pressure of the intensity of the currents transmitted through moderate contacts has been the subject of numerous researches made by Ochorowicz, Ferrini, Barrett, C. Cooke, Nosworthy, &c. I give the following extract from a work presented by me to the Academy of Sciences, July 29th, 1878 (p. 191) :—

"I think that up to the present, the physical effects produced at the points of contact of conductors traversed by a current have not been sufficiently taken into consideration. There is undoubtedly a resistance to the passage which varies with the pressure exercised upon the surfaces in contact. Does this effect arise from the fact that, in consequence of this pressure the surface of the contact is more developed by a partial flattening, equivalent to an increase of the section of the conductors? Or should it be attributed to the repulsions taking place between the contiguous elements of the same current, which being effected more easily with slight contacts than close ones, would tend to suppress them? All these ideas come into one's mind when the phenomenon is observed, but they require to be thought out, and I call the attention of experimentalists to the subject. It is always noticeable that the more considerable the resistances to the passage and the greater the number of contacts, the more marked are these effects."

In a communication addressed to the Royal Society of Dublin, February 17th, 1879, Professor Barrett attributes the effects in question to the contact more or less close between the molecules of the conducting substances placed face to face under the influence of pressures more or less powerful exercised upon them. He quoted in support of his opinion an experiment which we think worth describing and which was recently published in the *Electrician* of May 6th, 1882.

He places in the bell-shaped part of a long barometer siphon tube, open at both ends, a button of carbon prepared after Edison's method, and placed so as to form a stopper some millimetres below the orifice of this part of the tube; he pours over it a certain quantity of mercury which he puts in electrical communication with an electric circuit into which a Wheatstone bridge is introduced, and he fills with the same liquid the lower part of the siphon until the mercury reaches the level of the under surface of the carbon stopper. Under these conditions, the carbon is situated between two electrodes of mercury in perfect contact with it, and no pressure is exercised upon its under surface; so that by putting the mercury into communication with the circuit of the measuring apparatus by the bent part of the tube, it becomes easy to measure the resistance of the carbon between the two electrodes without having to take into account the pressure exercised upon it. Now, if we pour into the long part of the tube different quantities of mercury of known weight, we can submit the carbon to different pressures easily calculated, without in any way altering the conditions of good contact, and we may observe, by the variations of resistance, the influence exercised on the intensity of the current through the system. Now, in the numerous experiments which he has undertaken with this apparatus, Mr. Barrett has found that between limits of pressure varying from two to thirty centimetres, the resistance of the carbon did not seem to alter appreciably. It kept at two ohms, and the variation scarcely reached the tenth of an ohm.

"We see, therefore," says Mr. Barrett, "that when very close contact is established between the two surfaces of a carbon, an increase of pressure causes no variation of resistance. Consequently, the pressure only acts in carbon telephones as in microphones, by the greater or less number of points of close contact established between the two bodies placed face to face, which allow the current to pass through them more or less easily. If we use spongy platinum instead of carbon, the same effects are produced, and with this material we can even construct good telephone transmitters."

We agree to a certain extent with Mr. Barrett, and, as has been said above, I had, as early as 1874, attributed the variations produced by pressure exercised upon imperfect contacts, chiefly to *closer contact* between the two surfaces; but, according to M. Ferrini, the effects are somewhat more complicated, for in the actions caused by pressure upon bodies of moderate conductivity, two effects are produced independently one of another, one which is momentary, and which disappears when the pressure is restored to its original force, the other, which is more or less lasting, and which is often observed after the original pressure is restored. This last effect augments with the increase of pressure, and tends to diminish the general resistance of the moderately conducting body. This last effect is no doubt attributable to a loss of elasticity in the conductor, which causes certain groups of molecules, after having been pressed together in consequence of the pressure brought to bear upon them, to take a certain time in regaining their orginal equilibrium. This effect is in no way contradictory to the explanation we have given, but, on the contrary, helps to support our opinions. The question is somewhat complicated, as M. Ochorowicz has shown, and, if our readers wish to study it in detail, we will refer them to his articles published in *La Lumière Electrique* of October 15th, November 15th, and December 1st, 1879, and also to M. Ferrini's article, published in the same journal, January 15th, 1880.

Lately, in connection with the lawsuits which have taken place in England concerning the telephone, Mr. Conrad Cooke undertook several experiments in order to prove that the variations of resistance resulting from pressure are not produced under the same conditions with hard carbons as with soft ones. Thus, he shows that if a carbon pencil is placed between two blocks of the same material, and forms part of a telephonic circuit, no sound is obtained in the telephone when the upper block is struck with a hammer; but if the piece of carbon interposed is of a soft or spongy nature, these blows of the hammer are heard perfectly in the telephone. He concludes from this that, in the first case, the variations of intensity in the current arise from a variation in the resistance of the surfaces of carbon in contact, a variation which can only be very slight and in proportion to feeble pressures, whereas in the other case the variation results from a change of conductivity in the whole mass. This explanation does not in any way contradict the ideas we have expressed from the beginning.

This experiment of Mr. Conrad Cooke has, however, been contested by Mr. W. F. Nosworthy, who has heard very clearly blows struck upon coke carbon with or without an induction coil in the circuit; but it was necessary that the telephone should not have a high resistance when no induction coil was used. In short, Mr. Nosworthy considers it beyond a doubt that the conductivity of carbon increases with the pressure, whatever may its be nature and its degree of hardness, this increase being capable of rising to from 18 to 30 and even 40 per cent. under high pressure. However, he thinks that the effects of pressure resulting from the sound waves on contacts of this nature would be so slight as to be scarcely appreciable on the measuring apparatus with hard carbons; so that the variations of resistance under the influence of pressure would not in themselves be sufficient to explain the effects observed; we must, therefore, go back to the explanation which I had given at first, taking into account the *closeness* of the contact and the size of the section of the conductor at that point. The experiments of Messrs. Barrett and Ochorowicz also seem to prove this. We refer those interested in this question to Mr. Nosworthy's article, published in the TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW, of May 20th, 1882.

In short, the effects produced by pressure on the conductivity of bodies are important phenomena which have, it is true, passed unnoticed until the time when I made my first researches, but which are not so simple as they seem to be thought by Mr. Dolbear and several *savants* who are contented with a first glance. Since 1865, M. Clerac, in France, and Mr. Elsasser, in Germany, have made important applications of them to instruments of variable resistance, and when Edison applied them to telephony, people who at first doubted their existence, began to discover them everywhere, even where they do not exist. Such a course, calculated to injure the credit of true discoverers, can only influence seriously those who do not understand the subject, but truth always declares itself at last.

## THE GREETSIEL-VALENTIA CABLE.

THE *Archiv für Post und Telegraphie* gives the following information as regards the laying of the cable from Greetsiel to Valentia:—

"An event of great importance to international relations has just taken place in Emden, the ancient town of the Frisians. On the 22nd April last the submarine cable laid between Greetsiel (near Emden) and Valentia (on the west coast of Ireland) for the German Union Telegraph

Company, under the auspices of the German Imperial Telegraph Administration, was opened for traffic by the Secretary of State for Posts and Telegraphs of the German Empire. The opening of this telegraph line is to be considered a new and important phase in the annals of the development of the German traffic, as it has realised the so long desired establishment of a direct communication between Germany and North America.

Since 1872 the telegraph traffic between Germany and North America has passed over the lines of the German Union Telegraph Company. By virtue of a concession, obtained on the 12th of March, 1869, this company had a cable laid in 1871 between the German coast (near Emden) and the English coast at Lowestoft. This cable, which was opened for traffic in 1872, was composed of four conductors, two of which were destined for the Anglo-German traffic, the third for the traffic between London and Vienna, and the fourth for the traffic between Germany and America.

This latter route, which was used until lately, leads, starting from the landing point of the German cable at Lowestoft, by an overhead wire through England, and from there by submarine cable down the St. George's Channel, and then again by an overhead line through Ireland to Valentia, where the connection is made at last with the cables of the Anglo-American Company.

Ever since the opening of this line, established on rather complicated conditions, the telegraph traffic between Germany and North America continued to increase. Whilst in 1873, the total number of messages sent by this route amounted only to 20,600, this number amounted in 1880 to 106,000 messages. The telegraphic relations between Germany and England also increased very considerably, more especially since the reduction and the simplification of the Anglo-German tariff; in 1873 the number of messages amounted to 310,000, whilst in 1880 this number rose to 635,000.

A not less considerable increase took place in the traffic for which Germany serves as transit and to this should be added, since 1876, a great part of the messages interchanged between England and Austria and Hungary and the countries beyond these. Through this increase in the traffic, the necessity to increase as well the means of communicating was more and more felt in Germany.

In 1875 the Imperial Telegraph Administration had already projected the establishment of a special line, that is to say, to lay themselves a cable between the German coast and the American coast (through the English Channel or to the North of Scotland). The cost, however, of such an undertaking (which would have amounted to 25,000,000 marks) appeared to be far too much out of proportion with the importance of the traffic to allow of the execution of such a grand project.

On the other hand, a more careful examination of the question has made the idea prevail, that for the transmission between the Irish and American coasts an increase in the existing lines was not yet necessary. The quick transmission of the telegraphic correspondence between Germany and America may be considered, for a long time yet, as certain, by the fact that the use by the German Union Telegraph Company of a transatlantic cable for their special service has been guaranteed for a series of years by the contracts they have made with the Anglo-American and transatlantic companies.

To this should further be added, the conviction that an excessive increase of traffic on the transatlantic cables was not to be feared; the number of these cables having lately been increased by two new lines, and a further increase of which is still in prospect.

Under these conditions the Imperial Telegraph Administration resolved to forego their first project, and to aim in the first place at the establishment of a submarine line with Valentia, by means of which the direct connection could be obtained with the transatlantic communication which has been guaranteed for years to Germany.

During last summer a contract was made to that purpose between the Imperial Telegraph Administration and the German Union Telegraph Company, under the conditions of which steps were to be taken immediately for the laying of a one-conductor cable through the English Channel to Valentia. This undertaking, so very important to the interests of the German traffic, has come to-day to a happy result, and the wish cherished for such a long time to create a direct telegraphic communication between Germany and America has at last been realised.

The cable with one conductor, made by the Telegraph Construction and Maintenance Company of London, with materials for a great part of German production, is of a superior quality, and has a total length of 894 nautical miles (= 1,654 kilos.), of which 11¼ nautical miles (= 21 kilos.) have been used for the subterranean section between Emden and Greetsiel. The weight of the cable is 4,300,000 kilos.; for the protecting metallic sheathing no less than 3,500,000 kilos. of iron of German manufacture have been used. The laying of the cable, starting from Valentia, only took the relatively very short time of seven days.

The line opened to-day to the traffic offers, besides the greater security in working it, exposed as it used to be on the English route employed till now to frequent interruptions of the overhead lines, the further advantages of a quicker transmission of the messages, as a re-transmission, to arrive at the junction with the transatlantic lines is now no longer necessary. Besides, and what is also very important, the tariff now in force for the Anglo and Franco-American traffic will be applied as well on the new line to the traffic between Germany and America. The present charges will, therefore, be considerably reduced; the price for messages from Germany to New York will now only be 1·05 marks per word, which up to this time used to be 1·40 marks per word.

The new line will further be useful to the traffic between Germany and England, as the conductor of the Borkum-Lowestoft cable becomes free, and thus supplies the means of a quicker transmission of the Anglo-German correspondence, which is continually increasing.

## THE DANGERS OF ELECTRIC LIGHTING.

WE have on various occasions called attention to the dangers attendant on the employment of dynamo-electric machines of very high electromotive force, and we are pleased to see that no less an authority than Dr. Siemens expressed himself before the Electric Lighting Committee to the effect that the currents of such machines would certainly be dangerous to human life. Dr. Siemens puts a lower limit on what may be considered safe than we should ourselves feel disposed to adopt, for we have frequently used 750 volts for cable testing of a peculiar nature, and during the tests have received accidentally severe shocks, but we would not deliberately put ourselves in the position to be strongly affected by such a current. So much moreover depends upon the condition of the person dealing with such matters. A shock which would be sufficient to kill those delicately organised would not injuriously affect others possessed of a more robust nature. When such an eminent electrician as Dr. Siemens gives an opinion that 350 to 450 volts would be dangerous to human life we may shortly expect that more notice will be taken of this important point, and that regulations will be framed to restrict the unlimited use of high tension currents. However well the conducting wires may be insulated there are always certain portions of the circuit exposed from whence one might chance to receive an injurious or fatal shock. In the employment of the incandescent systems of electric lighting no such danger as this is to be feared, and this fact alone speaks volumes in favour of the small lights. Where it is necessary to use arc lamps, we think the number on any one circuit might well and conveniently be limited to 10 or 12. When as many as 40 for instance are employed, as is the case with one particular system, it is not only necessary that the wires should be much more highly insulated for the greater electromotive force developed, but the chances of leakage are increased as the circuit increases in length. We should be pleased to know that electricians were giving more serious attention than has hitherto occupied their minds towards rendering the use of the electric light on a large scale more free from danger.

## SIEMENS' POTENTIAL DYNAMOMETER.

THIS instrument, which we here illustrate, has been more particularly designed for measuring electromotive forces in electric light apparatus. The arrangement consists of two vertical galvanometer coils between which is placed a small permanent horseshoe magnet (shown separately by the small

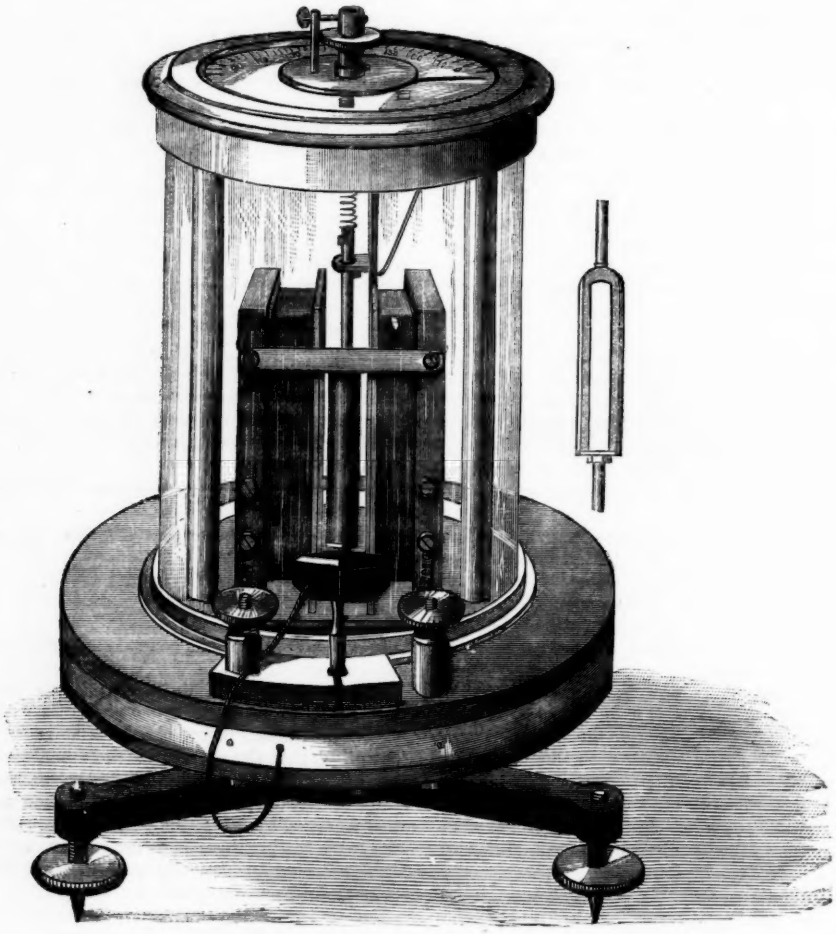


figure). This magnet is suspended by a silk fibre*, which passes through the axis of a spiral spring whose lower end is fixed to the top of the magnet, the other end being attached to a pointer which can be moved round a graduated scale. By turning this pointer, any required degree of torsion can be given to the spring, as in the "current" dynamometer (ELEC. REVIEW, p. 97). In using the instrument, the two points, between which the electromotive force exists, are connected to the terminals, and then the pointer is turned until an index needle fixed to the magnet is brought back to zero. The number of degrees through which the pointer has been turned being noted, then a similar observation is made with a known electromotive force; this being done the relative values of the two electromotive forces are proportional to the squares of the numbers of degrees through which the pointer is rotated. The coils of the instrument are wound to a high resistance, so that their introduction between any two points (the terminals of an electric lamp or of a dynamo machine, for example) in a circuit does not influence the normal condition of the current to any appreciable extent.

* This has been accidentally omitted in the figure.

## TRUST COMPANIES.

As regards these companies, we belong to the number of those who have little—yea, exceedingly little—faith in them. They are usually put forward by promoters, on account of the safety which is said to be obtained by the division of risk amongst several different investments, which division is impossible where investors with only small amounts at command are concerned. In common parlance they may be stated as a means for avoiding the placing of your eggs all in one basket.

Now, in the case of electric light shares, nearly all of which are of small amounts, say of £1 to £5, the desirability or necessity of such Trusts is by no means apparent; the investor would, in seeking to lessen his risk by dividing his investment, do better to take a few shares in each, through the medium of a broker, rather than have to pay promoters' profits, and direction, and other expenses incidental to the working of such companies; for it is unfortunately the *small* investor, who can least afford to lose his money, who is caught by the arguments generally adduced by the *philanthropic* gentlemen who make it a business to launch such schemes.

As a general rule Trust companies offer no advantages whatever which to us are perceptible; on the other hand, they may, and usually do, engender expenses quite superfluous and unnecessary to those seeking investments, and beside they hold out a direct temptation to those who direct them to manipulate to their own advantage large quantities of stock in the Stock Markets, and thereby to remunerate themselves, generally at the expense of their own shareholders.

Three of these Trust companies to invest in electrical companies' shares have this year been registered, and after the preceding remarks our readers will not be surprised if we fail to advocate the establishment of such bodies. One of these companies, the last to issue its prospectus, namely, "The Electrical Share Trust, Limited," states that its capital is to be £500,000, in 100,000 shares of £5 each. The directors, with two exceptions, apparently gentlemen of some commercial experience, are :—

T. Reid Arnott Esq. (Arnott Bros. and Co., Limited, London and Liverpool), Hillside, Willesden, N.W.; Arthur Barff, Esq. (Director of the Devon and Somerset Railway, and of W. McConnell Company, Limited, Ancoats, Manchester), Ashburn Place, Cromwell Road, S.W.; Frederick Friend, Esq. (F. Friend and Co., Merchants, King William Street, E.C.), Woollet Hall, North Cray, Kent; W. H. Harris, Esq. (late Deputy Surgeon-General Madras Army), 78, Oxford Gardens, W.; General H. Campbell Johnstone, C.B., East India United Service Club, S.W.; Hugh Watt, Esq. (Hugh Watt and Co., Merchants, London and Liverpool), Lawrie Park, Sydenham, S.E.

The document then proceeds to say :—

The favour with which electric light and power, as also telephone companies, have been received by the public, indicates the necessity for the formation of a trust as a medium for diminishing the risk of investments in these undertakings by spreading them over a wider area.

The advantage of having a source through which the investor may have his capital employed in a variety of profitable undertakings, instead of locking it up exclusively in one investment, must be patent.

These paragraphs read very well, but it must also be evident that it is safer to rely on one stout plank than to depend on several equally weak ones. Again it says :—

Having regard to the large amount of capital recently invested in electric light companies established to work one particular system, amounting already in the aggregate to about £10,000,000, and considering the great probability of new developments in electricity which may entirely supersede the pioneer systems, it is obvious that the formation of such a trust as the present is most opportune, meets an existing want, and the suggestion has already received the approval of the highest authorities.

Which does this company propose to do—deal in the shares of those systems which have *yet* to be developed, or in those now existing, but regarding which it states, that through *the great probability of new developments in electricity* may be entirely superseded. If the first, is not the advent of this company premature? If the latter, we should prefer to wait for the new developments.

Electric lighting and telephone companies have opened up an immense field for the employment of capital, and probably such undertakings will become eventually as numerous as gas and kindred companies. Although at present electric lighting shares are commanding extraordinarily high premiums, they are certain, in the majority of instances, to settle down and maintain a permanent place among sound recognised securities.

Quite so; when there are more companies the premiums will probably have settled down, and then will be the time for investors; therefore, had not the said company better wait until this happy time is nearer?

The trust companies hitherto formed have, almost without exception, proved most profitable, and the present prices of shares of the companies show the appreciation in which this class of security is held by the public:—

American Investment Trust, £100 shares; fully paid. Present value £115.

British and Australian Trust and Loan, £25 shares; £2 10s. paid Present value £4 10s.

Foreign and Colonial Government Trust, £100 shares; fully paid. Present value £117 10s.

New Zealand Trust and Loan, £25 shares; £5 paid. Present value £18 5s.

Railway Debenture Trust, £20 shares; £10 paid. Present value £12 5s.

Railway Share Trust, £10 shares; fully paid. Present value £11 5s.

Submarine Cables Trust, £100 shares; fully paid. Present value £103 10s.

Trust and Loan Company of Canada, £20 shares; £5 paid. Present value £5 10s.

To the statement above this list of trust companies we must emphatically object; indeed, we will take one out of the number mentioned—namely, the Foreign and Colonial Government Trust Company. This company was originally called a Trust, although now it is reconstructed (we think that is the convenient term used in such cases); it is called "The Foreign and Colonial Government Trust Company, Limited." A share in this company of £100, nominal, before its reconstruction, is now worth in the regenerated company about £85, a discount of 15 per cent., not a premium of 17 per cent. as the prospectus would lead one to infer. The devil may quote Scripture when it suits his purpose so to do; but we think that those who undertake to start such companies as that from whose prospectus we have been extracting, should at least have sufficient knowledge of what that prospectus contains to avoid making statements which are only nominally correct.

To return to Trust companies generally, our present experience of them is not encouraging, and we should advise investors to well consider what they are about lest they fritter their property away in these usually too seductive schemes.

## ALTERNATING CURRENT MACHINE.

### (CHERTEMPS AND DANDEU SYSTEM.)

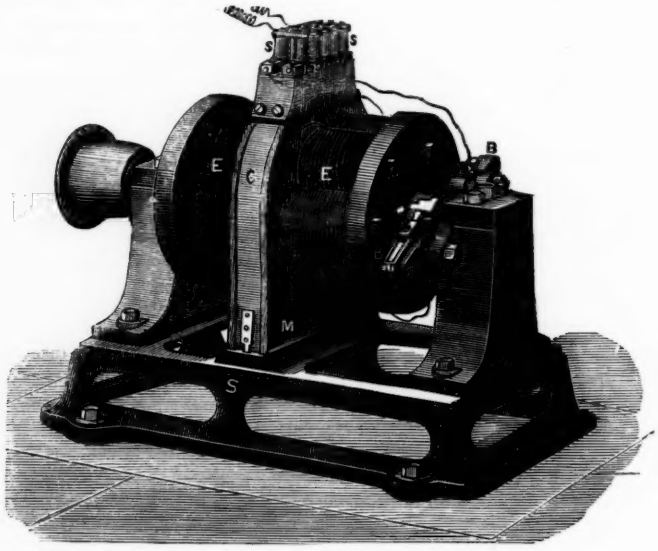
[The following description of this new alternating current machine is written by M. Frank Geraldy for our contemporary, *La Lumière Electrique*. One of these machines having recently been brought to England, we hope shortly to put before the notice of our readers a more complete description and experimental data than is contained in M. Geraldy's sketch.]

THIS machine is something between Wilde's machine and Lambotte-Lachaussée's. In its general form it resembles that of Wilde, and, like it, consists of coils placed in a circle on discs revolving before one another. As in the Wilde machine, the coils form three series, as shown in the figure. In the model used for experiment, two series of six coils each are arranged on the end plates at E E, constituting the inductor; a series of six other coils arranged on a plate between constitute the induced part. In the Wilde machine this middle plate is movable, the induced part revolves and passes before the inductor, which is fixed; in that of Chertemps and Dandeu the reverse is the case, the plate M bearing the induced coils is a fixed piece of wood, and it is the plates E with the inducing coils which revolve. This arrangement, which is also adopted in the Lambotte-Lachaussée machine, has several advantages, of which the chief is that the induced part can be better observed, which is the part requiring the greatest attention, since it alone is traversed by the working current. In all machines the inductor is actuated by a constant, continuous current, usually supplied by another machine. This is the case in the Lambotte-Lachaussée system. This question need not trouble us, as the machine we are describing is self-exciting like the Wilde machine. It obtains its exciting current from one of its induced coils, the current of which is made to flow in one direction. For this purpose the current of one of the coils is brought to the brushes, B $B^1$, and passes into the inducing coils, passing through a commutator which at each moment sends it in the direction required. We need not dwell further on this process which is already known.

A very interesting peculiarity of this machine is to be observed at the upper part, where a series of coils is placed. With this object, as we might suppose, the fixture of the induced part has been turned to account in order to render combinations of circuits possible at every moment, which is one of the advantages of this method of arrangement. For this purpose the circuit of each induced coil is brought separately to two terminals on the upper plate of the apparatus, where it can be employed either separately or in combination with the others.

A piece of metal forming a slide will facilitate these combinations. But each of these circuits at starting passes into two little coils forming an electro-magnet. This magnet is furnished with a little armature which, when lowered, unites the two poles of the circuit of the coil. The result of this arrangement is, that when a coil is not furnished with an outer circuit through which a current passes, the armature connects the two poles and closes the

circuit; as soon as an outer circuit is formed the electro-magnet acts and raises its armature, so that the outer circuit alone remains and receives all the current. This is necessary because the alternating machines of this type, unlike the continuous ones, require less force when the circuit offers less resistance. In these systems the breaking of the circuit is a serious matter; the machines immediately absorb a great deal of force which they transform into heat in the iron cores of the coils; it is desirable therefore that such an occurrence should be impossible, and that the circuit should be automatically closed upon itself if it happened to




be opened externally; this is the advantage of the Chertemps and Dandeu apparatus. It is almost indispensable for systems of this type, *i.e.*, where the iron cores of certain mass are put in motion in alternate magnetic fields. We may imagine that under these circumstances, the exciting current always acting independently of the circuit to be utilised, the pieces of iron are continually being magnetised, and in order to make them pass one before the other, considerable attractions must be overcome. This is not the case in machines like the Gramme, in which the soft iron of the induced coil is in the form of an endless ring. In this case the action of the inductor consists in displacing the poles of a continuous mass, and no doubt this demands some expenditure of force on account of the Foucault currents developed in the metal, but this expenditure is far less than that required by the other method. This machine, like the Gramme, easily realises the high tensions generally required from an apparatus of the kind; it is coiled with wires of somewhat small diameter and of rather high resistance, being constructed to act at long distances. In this it follows the general tendency entered upon by alternating machines at the beginning. Experiment shows that the force absorbed increases almost in proportion to the electrical work produced, which is advantageous for the full utilisation of the motors. The machine is very compact and of small dimensions. In the experiments which have been made, by making it revolve at a speed of about 1,300 revolutions, 10 Jablochkoff candles of $4\frac{1}{2}$ mm. were lit and maintained in steady action, a remarkable result for so small a machine. It was also shown that the current was capable of passing through high resistances. In short, it seems to take a good position amongst alternating machines.

## ANOTHER ELECTRIC LIGHT RE-ARRANGEMENT.

MR. ROBERT HAMMOND has agreed to join the board of the Metropolitan Brush Electric Light and Power Company, Limited, a working arrangement having been entered into between that company and the Hammond Electric Light and Power Supply Company, Limited.

## SIMPLE SOUND RECORDER.

By GEO. M. HOPKINS.

[The description of this simple and admirable little instrument for registering sonorous vibrations we extract from the *Scientific American*. Many of our readers interested in telephony and kindred subjects may probably be induced to construct such an apparatus for private researches.]

THE complex nature of sonorous vibrations is beautifully exhibited by the records made by the phonautograph; but the instrument is so bulky, so expensive, and so inconvenient to use that few students are able to avail themselves of actual experiments in this direction.

The annexed engraving shows an exceedingly simple device, by means of which sounds may be autographically recorded fully as satisfactorily as with the phonautograph. The main difficulty with this sort of apparatus seems to have been the propelling of the smoked plate at a uniform rate of speed under the stylus. In the instrument illustrated this is accomplished by simply inclining the support of the plate and allowing the plate to slide off quickly by its own gravity.

This apparatus consists of a wooden mouthpiece like that of a telephone, with a parchment diaphragm glued to its back, and provided with a tracing point, which is slightly inclined downward toward the guide for the plate.

This tracing point is a common sewing needle, having its pointed end bent downward. It is cemented at the eye end to the centre of a diaphragm by a drop of sealing wax. The mouthpiece is attached to a base supporting the crosspiece upon which the smoked plate is placed.

A thin strip of wood fastened by two common pins—one at each end—serves as a guide for the smoked plate.

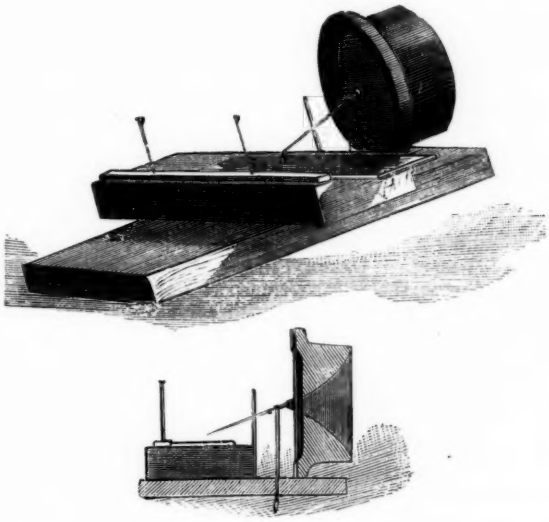
To prevent the needle from being deflected laterally by the moving glass a long needle is driven down into the base-board in contact with the tracing needle; and to give the needle point sufficient pressure to keep it in contact with the smoked plate a very small rubber band is slipped over it and drawn down through a small hole in the baseboard, as shown in fig. 2, until the necessary tension is secured.

The best plates for the purpose of making the tracings are the microscope slide glasses with ground edges. They may be readily smoked over a gas jet turned down quite small, or over a candle or kerosene lamp. The flame in any case should be small and the film of smoke fine and very thin.

The smoked plate is placed on the support and against the guide and under the needle, and the instrument is inclined until the plate rests against the guide. Now the mouth is placed near the mouthpiece, and a vowel is uttered, while the instrument is inclined sidewise at a sufficient angle to permit the glass to slide off quickly. Of course the glass

should fall only a very short distance, and it is well to provide a soft surface for it to alight on.

If all this is done with the slightest regard for precision a beautiful tracing will be secured, which will show the composite nature of each sound wave. It is surprising how perfectly regular and uniform the entire tracing will be, considering the comparatively crude means employed in producing it.



The beginning of the sinuous line will be somewhat imperfect owing to the slow initial movement of the plate in its descent, but the greater portion will be found perfect.

After having made one line, the pins holding the guide are moved forward, placing the guide in a new position, when the operation of tracing may be repeated with another vowel. Monosyllables and short words may be recorded. If the plate is made long enough it will, of course, receive an entire sentence.

These tracings may be covered with a second microscopic glass plate to protect them, or they may be mounted as a microscopic object for a low power by putting a thin cover over them in the usual way. Used as a lantern slide they give fine results.

## CORRESPONDENCE.

### TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer, not necessarily for publication, but as a guarantee of good faith.

Correspondence should arrive not later than Tuesday morning if it is desired to appear in the following number.

### THE TELEPHONE CASE.

*To the Editors of* THE ELECTRICAL REVIEW.

DEAR SIRS,—Being a subscriber to your paper and reading with great interest your reports and articles on the recent "Telephone cases," I take the liberty of enclosing a copy of a printed letter, which I as well as all the other customers of Mr. Alexander Maclean received this morning; so that you may publish it in the Review, if you think it will serve any good end.

It seems a very hard case indeed, that we should have to give up instruments purchased in open market in all good faith.

You will notice that the Telephone Company claims Transmitters as well as Receivers.

I am, dear Sirs, yours faithfully,

Kirkcaldy, 1*st June* 1822. WILLIAM D. SANG.

"SIR,—You are probably aware that an action was raised some time ago in the Court of Session at the instance of the United Telephone Company (Limited), against Alexander Maclean, Electric Engineer, West Register Street, Edinburgh, to have him interdicted from infringing Patents belonging to the Pursuers, the ground of action being that he, Mr. Maclean, was making and supplying (first), Receiving Instruments, which infringed the Magneto-Telephone invented by Mr. Graham Bell, and patented in this country by Mr. Morgan-Brown, and (second) Transmitting Instruments which infringed those invented and patented by Mr. Edison, both patents being now owned by the United Telephone Company. In the action, a judgment was pronounced by Lord M'Laren on 1st February, 1882, by which his Lordship sustained the validity of both patents, and granted interdict against Maclean. This judgment was reclaimed by Maclean to the First Division of the Court of Session, but he having afterwards abandoned the Reclaiming note, the judgment was made final by Interlocutor of the First Division, dated 19th May, 1882.

"We are informed that you are using both a Receiving and Transmitting Instrument, which are infringements of the Patents above referred to, without any license from the United Telephone Company (Limited), or those empowered by them to grant licenses.

"It is not wished to act harshly towards those who have in ignorance of the company's rights rendered themselves liable to an action for damages, and we are therefore instructed to inform you that if the instruments which you use are given up within one week from this date to the Licensees or Agents of the United Telephone Company, viz., the National Telephone Company (Limited), at the address given below, and if, at the same time, the name and address of the person from whom you purchased the instruments are furnished, no claim for damages will be made against you.

"The National Telephone Company will be able to inform you on what terms instruments duly licensed can be supplied in place of those given up.

"We are, dear Sir, your obedient Servants,

"(Signed) DAVIDSON & SYME.

"22, Castle Street, Edinburgh, 31*st May*, 1882."

Name and address to above, National Telephone Company (Limited), 38, Frederick Street, Edinburgh.

### THE CANDLE-POWER OF ELECTRIC LAMPS.

*To the Editors of* THE ELECTRICAL REVIEW.

SIRS,—I notice in your issue of the 3rd inst. a letter by "Electron," in which he quotes from the *Journal of Gas Lighting* what he is pleased to term faults in the Brush system of electric lighting.

The first instance he mentions is that of the House of Commons, with respect to which I may say that the Brush lights as tried at this place worked perfectly, and the only reason that their use was discontinued was that the members did not like the "white light."

At York, where temporary work connected with the British Association meeting was undertaken by us, the total installation, amounting to something more than 45 lights, was erected in a very few days, leaving no opportunity for testing, &c., the last lamp being hung up and put into place only a few minutes before the opening run was made; in spite of this, however, the lights in the city were not regarded as a failure, and those which were erected in York railway station are still in operation and are giving very great satisfaction to the North Eastern Railway Company, who now have 24 lights altogether.

As regards the lights at Barnsley, they were in every way a success and admitted to be so by everybody, but the arrangement made with the Barnsley Corporation was only for a temporary run, and, if nothing more, it had this good effect, that a reduction in price of gas was made which amounted to more than £100 off the yearly gas bill.

As regards the lights at Scarborough, these were put up for a given period, and it was not the intention of the Spa Company to retain their use after a certain date, and on this date they were of course taken away.

With reference to the lights at Edinburgh, I may say that the unsatisfactory operation of these was due entirely to a

most curious complication of adverse circumstances, and not to faults in the system itself. It may be mentioned that the last week of their operation was eminently satisfactory to every one, the faults of the installation having been repaired.

The complete success of the London lighting by the Brush system is admitted on all sides (notably by the Corporation itself, need I add ?), and this success any practical man will admit can be obtained elsewhere with the sole condition of a proper installation; and the fact of any one hasty or imperfect installation having been somewhat unsatisfactory does not therefore show a defect in the system.

It may be interesting to your readers to know that there are 17,000 Brush lights in operation in America and 3,000 in England. This immense number of lights have come into use notwithstanding the continued exertions of its opponents in deprecating the system.

It might also be interesting for your many readers to know that Messrs. Ayrton and Perry, by their improved method of determining the candle-power of electric lights, have found that the ordinary Brush lamps yield 2,000 candle-power each.

Yours faithfully,

F. C. PHILLIPS,

Consulting Electrician to the Anglo-American Brush Electric Light Corporation, Limited.

## TELEPHONE EXCHANGES.

*To the Editors of* THE ELECTRICAL REVIEW.

SIRS,—I should feel greatly obliged if you would kindly afford me information on the following :—

1. For short lines in a telephonic exchange is it advisable to employ metallic circuits ? If so, up to what length of line should these be employed ?

2. What are the best means to employ in order to protect the numerous wires entering a telephonic exchange from the effects of induction ?

3. Is half an inch too short distance to have between two wires running parallel together, say, for twenty or fifteen yards ? If so, what is a safe distance apart to insure them against induction ?

Yours obediently,

PROGRESS.

[In cases where telephone wires are attached to poles the wires of which are exclusively employed for telephonic circuits there is no necessity for employing a metallic circuit, but if there are telegraph wires worked in the ordinary way, fixed to the same poles, a metallic circuit should be employed on even the shortest line. If the wires entering a telephonic exchange are not mixed up with ordinary telegraph wires the effects of induction will not be felt to any appreciable extent. For the span you mention, six inches is the minimum distance that should be allowed between telephone or telegraph circuits, not only to avoid induction but to prevent the wires being blown together in contact.—ED. ELEC. REV.]

## ELECTRICAL APPOINTMENT.

*To the Editors of* THE ELECTRICAL REVIEW.

DEAR SIRS,—We beg to inform you that the Directors of the South-Eastern and Provincial (Brush) Electric Light and Power Company, Limited, have appointed Mr. Joseph S. Beeman, Asso. Mem. Inst. C.E., Mem. Soc. Tel. Engrs., Mem. Soc. Engrs., and late Inspecting Engineer of the Anglo-American Brush Electric Light Corporation, Limited, as Engineer and Electrician to the above Companies.

Yours faithfully,

GEO. OFFOR, *Manager*.

The South-Eastern (Brush) Electric Light and Power Company, Limited, 110, Cannon Street.

*June 5th*, 1882.

## PRACTICAL INFORMATION FOR TELEPHONISTS.

[In answer to several inquiries we believe that the book on the above subject may be obtained at the office of the *Operator*, 9, Murray Street, New York; price 1 dol. Sent to any country in the Universal Postal Union on receipt of that amount.—ED. ELEC. REV.]

# NOTES.

THE "TIMES" AT IT AGAIN.—It is really too bad of the *Times* to infer that any man is an "old woman." Yet in its issue of the 7th inst., in reporting a meeting for "The Great International Fisheries Exhibition, 1883," it states that amongst those present was Mrs. John Pender, M.P.

CENTRAL AND SOUTH AMERICAN TELEGRAPH COMPANY.—The India-rubber, Gutta-percha, and Telegraph Works Company received on the 1st inst. a telegram from Mr. R. Kaye Gray, their engineer-in-chief, announcing the completion of the Santa Elena-Buenaventura section of the Central and South American Telegraph Company's cables, on the 30th ult. This is the first of the five sections to be laid by the ss. *Silvertown*. The telegram further mentioned that the ss. *Silvertown* was to proceed the next day (31st May) with the laying towards Panama. All well on board.

THE DISABLED CABLE SHIP "CHARENTE."—We are informed that the French transport *Charente*, which was adrift in the Bay of Biscay, with engines disabled, which circumstance we alluded to in our issue of the 27th ult., has been towed in the port of Ferrol for repairs.

THE INDIA-RUBBER AND GUTTA-PERCHA COMPANY'S SS. "DACIA."—The ss. *Dacia*, Captain P. M. Hayward, belonging to the India-rubber, Gutta-percha, and Telegraph Works Company, arrived at the moorings off the Silvertown works, on the 1st inst., on her return from the West Coast of South America. That this splendid vessel has been well occupied during the last three years, with laying and repairing submarine telegraph cables, is shown by the following data :—

| | |
|---|---|
| Chartered by H. M. Post Office ... ... ... | May 4, 1879. |
| Returned to Silvertown ... ... ... ... | July 25, 1879. |
| Left Silvertown for the laying of the Marseilles-Algiers cable and subsequent repairs of the Lizard-Bilbao cable ... ... ... ... | Sept. 3, 1879. |
| Returned to Silvertown ... ... ... ... | Nov. 16, 1879. |
| Chartered by H. M. Post Office ... ... ... | Jan. 1, 1880. |
| Returned to Falmouth ... ... ... ... | Feb. 9, 1880. |
| Left Falmouth for the repairs of the Lizard-Bilbao cable ... ... ... ... ... ... | Feb. 13, 1880. |
| Returned to Silvertown ... ... ... ... | March 22, 1880. |
| Left Silvertown for the laying of the Marseilles-Algiers cable ... ... ... ... ... | Sept. 11, 1880. |
| Returned to Silvertown ... ... ... ... | Oct. 18, 1880. |
| Left Silvertown for the laying of the Mexican Telegraph Company's cables, and subsequent repairs of the Havannah-Key West cables ... | Dec. 6, 1880. |
| Returned to Silvertown ... ... ... ... | July 26, 1881. |
| Chartered by H. M. Post Office ... ... ... | Aug. 4, 1881. |
| Returned to Silvertown ... ... ... ... | Nov. 7, 1881. |
| Left Silvertown for the laying of the Central and South American Telegraph Company's cables | Nov. 15, 1881. |
| Returned to Silvertown ... ... ... ... | June 1, 1882. |

During these three years the ss. *Dacia* has been laid up only once, namely, from April, 1880, to September, 1880, but during that time she was thoroughly overhauled and fitted with new deck houses, steam-sounding gear, new electric light machinery and fittings, electric bells, &c.

INTERNATIONAL EXHIBITION OF ELECTRICITY IN VIENNA.—In *La Lumière Electrique* of the 3rd inst. we read as follows :—A meeting has taken place in Vienna under the presidency of Baron Erlanger, in the buildings of the Bourse, with a view of making the preliminary arrangements for the International Exhibition of Electricity, which, as we have stated before, is to be held in that town during the months of September and October next. It was announced that the Minister of Commerce had authorised the installation of this exhibition in the Rotunde (a part of the Exhibition buildings of 1873), and that the Ministries of Commerce and War would be represented. Local committees are being formed already in Germany, France, Holland, and a number of firms in England, America, and Belgium, have intimated their intention to send apparatus. The General Committee of the International Exhibition of Electricity in Vienna consists at the present time of seventy-three members, and will be subdivided in a central committee of twenty-five members.

THE FRANKLIN INSTITUTE.—We find that we inadvertently omitted to notify that Mr. David Brooks, the well-known American electrician, was recently elected President of the Electrical Section of the above institute.

THE ELECTRIC LIGHT IN THE CITY.—At the fortnightly meeting of the Commissioners of Sewers last Tuesday an animated discussion took place respecting the electric light.

Mr. Peebles moved that it be referred to the Streets Committee to include in the future scheme of electric lighting Cannon Street, Walbrook, and St. Swithin's Lane. He said it was hardly necessary to remind the Commission that Cannon Street was a main artery of communication between the east and west. There were two railway stations in Cannon Street, which at present was very badly lighted. The South-Eastern Railway Company, for the benefit of their own passengers, lighted the front of their station with the electric light, the effect of which was to make the darkness in Cannon Street more "visible," and complaints had been made to him of the great danger experienced in crossing Cannon Street (hear, hear). Walbrook and St. Swithin's Lane were leading thoroughfares between the Bank and the Exchange and Cannon Street. He suggested that this district should be added to No. 4 section. He believed it would be more economical, and would not interfere with the tenders.

After a few remarks from some of the gentlemen present

Mr. Deputy Burnell moved as an amendment that they substitute "any" for "the," and change the word "scheme" into the plural.

Mr. Innes believed if Mr. Peebles accepted the amendment he would be three or four months nearer lighting the district referred to by electricity than if he persisted in his own motion.

Mr. Boor having supported the amendment, it was carried almost unanimously.

Mr. Johnson then moved that Bishopsgate Street Without be included in the next contract for electric lighting.

Mr. Lyon having seconded Mr. Johnson's motion,

Mr. Noon thought that if they took Bishopsgate Street Without they must also take Bishopsgate Street Within.

The Engineer thought the Commission a little forgot the object it had in having the electric light at all. It was not with the intention of permanently adopting the electric light, but to get an illustration of it, and compare it with the gas lighting, and for that purpose, under the direction of the committee, he selected districts of the City in which he thought the greatest number of people would be able to see it. Therefore the three districts were admirably adapted for the purpose, and Cannon Street was omitted because passengers passing through that street would have an opportunity of seeing the electric light in Cheapside and other places.

Mr. Peebles believed that if they did not restrict the electric light companies they would find electricity much cheaper than gas.

The amendment was agreed to.

ELECTRIC LIGHTING APPLIED TO PRIVATE PROPERTY.

Mr. Innes moved, "That leave and licence be given to electric lighting companies, who are lighting public ways, to light private property on the lines of their conductors." The tenders they had received for electric lighting amounted to five or six times the price of gas. The charge for electric lighting was not so large in itself, but the charge for inauguration was enormously heavy in consequence of the uncertainty the electric light companies were in as to whether they would have to continue the experiment. It was clear to men of business that the real prize aimed at was that of private lighting (hear, hear). Some tenderers had made it an absolute condition that they should have the power of private lighting, and by private inquiries it had been fairly discovered that had others got the power of private lighting their tenders would have been very different. He suggested that they should re-advertise, giving the right of private lighting.

Mr. Peebles seconded the motion. He strongly condemned the conditions issued by the Commission to those who wished to tender. He only wondered that they had obtained any tenders at all. There was no standard given, and the result might be absolute ruin to the interests of the company. In case of dispute provision should be made for the reference of the subject to an impartial electrical engineer.

Mr. Ashby pointed out that if they agreed to Mr. Innes' motion companies could at once proceed to break up the streets, and if they negatived the proposition they would be taking up a position they did not at present wish to occupy. He should therefore move "that the question be not put." He thought they should give the gas companies some consideration, especially as they were not at present able to go on without the aid of the gas.

Mr. Johnson seconded the amendment. If they once gave liberty to the public companies to light private property, he believed they would have great difficulty in getting rid of them.

Sir John Bennett agreed with the most distinguished scientific men that gas would soon be superseded and extinguished. ("No, no!") At the same time, he did not think they should throw away their dirty water until they had got clean.

Mr. Manners thought it would be very unwise to give away the right to light the City, as some day they would want it for themselves.

Mr. Innes expressed his willingness to withdraw his motion, which was accordingly done.

Mr. Moore gave notice of motion, "That it be referred to the Streets Committee to consider whether steps should not be taken to provide that all arrangements for electric lighting in the City, necessitating interference with the pavement, be undertaken by the Commission."

THE PATENTS OF MR. EDISON.—The following notices have been issued relative to Mr. Edison's inventions:—

In the matter of letters-patent for the United Kingdom of Great Britain and Ireland, granted to Thomas Alva Edison, of Menlo Park, in the State of New Jersey, United States of America, for the invention of "improvements in dynamo or magneto-electric machines and electric motors," dated the 5th day of April, 1880, No. 1,385; "improvements in magneto or dynamo-electric machines, applicable to both generators and engines," dated the 30th day of September, 1880, No. 3,964; "improvements in connecting the ends of the carbon to the conducting wires in electric lamps," dated the 23rd day of February, 1881, No. 768; "improvements in electric lamps, and in the method of manufacturing the same," dated the 10th day of February, 1880, No. 578; and "improvements in systems of conductors for the distribution of electricity as a lighting and motive-power agent, and appliances connected therewith."—Notice is Hereby Given, that the Edison Electric Light Company, Limited, the assignees of the said letters-patent, have applied by petition to the Commissioners of Patents, according to the statute in that case made and provided, for leave to file in the Great Seal Patent Office a disclaimer and memorandum of alteration of certain parts of the specification of the said letters-patent, and that any person intending to oppose such application must leave particulars in writing of their objections to such proposed disclaimer and memorandum of alteration, at the Offices of the Attorney-General, No. 1, New Court, Temple, in the case of the odd number, and at the Offices of the Solicitor-General, No. 11, New Court, in the case of the even numbers, within 21 days from the date of the *London Gazette* in which this notice is published. And Notice is Hereby also Given, that after the expiration of the said 21 days no objection will be received or entertained, and the Attorney-General will proceed to a hearing.—Dated this 6th day of June, 1882.

J. HENRY JOHNSON, 47, Lincoln's Inn Fields, W.C.,
Agent for the Petitioners.

THE BURGLARS AND THE ELECTRIC BELL.—At Liverpool recently two young men were charged on remand under the following circumstances. On Whit Sunday morning the prisoners went to the premises of some timber merchants in Camden Street, which they succeeded in entering, but were smartly captured by means of an electric bell, fixed in such a manner that it is impossible to open the door to which it is attached without making it ring unheard by the person who causes it to give the alarm. The foreman was awakened, and at once informed the police. On the office being entered the prisoners were found crouched beneath a desk, and were then taken into custody.

AN ELECTRIC RAILWAY FOR ST. LOUIS.—We observe in the St. Louis *Republican* that Mr. Charles Heisler, the American electrician, is about to construct an experimental electric railway in that city. The cars will be two in number, and will each carry forty passengers. The speed at which they will run is estimated to be ten miles an hour, or more if the curves will allow of it. The track is of the narrow gauge type (3 ft. 6 in.), and the conducting wires will be connected with the rails. Mr. Heisler thinks that the railway will be in operation before next October.

TERRIFIC THUNDERSTORM AT BERLIN.—A Berlin telegram states that a terrific thunderstorm visited that city on Monday, the 29th ult. From half-past two to half-past three the fire brigade were summoned no fewer than twenty-eight times to extinguish fires caused by lightning, but there were no serious conflagrations. The storm, strange to say, was confined to Berlin and its immediate neighbourhood.

THE WINDING-UP OF THE SCOTTISH BRUSH ELECTRIC LIGHT AND POWER COMPANY.—Answers for the Scottish Brush Electric Light and Power Company, in petition for liquidation, were lodged in the First Division of the Court of Session, Edinburgh, on the 1st inst. In these answers it is said that the whole of the shareholders of the company, with the exception of the petitioners (the Anglo-American Brush Electric Light Corporation, Limited) are opposed to the present application. It may be necessary before long to take steps to have the respondent's company wound up; but it is inexpedient to do so at present, as there are still several things to be done which can be better performed before any resolution to wind up is determined on.

THE ELECTRIC LIGHTING BILL.—The Montrose Town Council have agreed to petition Parliament in favour of the Electric Lighting Bill.

A MAGNETIC STORM.—M. Mascart has described to the French Academy the effects of a remarkable magnetic storm as observed at the Collége de France. Indications of its approach began about April 6th, but its beginning may be dated at 11.15 p.m. on the 13th. A great shock occurred on the night of the 16th, affecting all the three magnetic elements. The needle was much agitated from 11.45 till midnight, an oscillation of 25′ being observed. A similar shock was experienced on the 20th, after which the storm gradually abated and disappeared.

LECTURE.—On the evening of the 31st ulto., Mr. A. F. Clement, North British Railway Telegraph Superintendent, delivered at Edinburgh a popular lecture on the Telegraph and Telephone. A large quantity of apparatus, chiefly that used for railway working, was exhibited in operation, communication being established with Glasgow. In the course of his lecture, Mr. Clement said that as the Glasgow Cowlairs Circuit had been the first in Scotland on which double needles were used, so perhaps he might say it was the last, for it was only in the preceding week that he had substituted single needle instruments.

INTERESTING TO TELEPHONE INFRINGERS.—The National Telephone Company's law-agents in Scotland have issued a circular to infringers of the Bell and Edison patents, stating that no claim for damages will be made against them, provided they give up the instruments and the name and address of the person from whom they were purchased. A letter on this subject will be found in our correspondence columns.

THE ELECTRIC LIGHT IN MINES.—The Witton Hall Rock Salt Mine, Northwich, Cheshire, was last week lighted up by electricity. Insulated wires are carried down the shaft, which is 112 yards deep, and attached to 16 lamps, which are suspended from the roofs. The illuminating power is equal to that of 32,000 sperm candles. The Hammond Electric Company were the contractors.

THE ROYAL SOCIETY OF EDINBURGH PRIZES.—The Council of the Edinburgh Royal Society has awarded the Keith prize for the biennial period, 1879-81, to Professor Chrystal, for a paper on "The Differential Telephone."

THE TELEPHONE.—A regular telephone system has been arranged between Brussels Observatory and the Meteorological station at Ostend—about 78 miles—after highly successful experiments with the Rysselberghe improved telephone.

ELECTRIC ARC LAMPS.—It is by no means an uncommon belief that arc lamps have had their day and that they will gradually fall into disuetude. It appears, however, that inventors have yet a fair field in this direction, if we may judge of the price required by the vendors for the latest advertised lamp. This is the "Standard" (Fyfe-Main), and the condition of purchase is the payment of £70,000 in cash and £100,000 in fully paid-up shares by the company forming to work this system. Included, however, for this sum is the Fyfe-Main Dynamo-Electric Machine, a patent for which, we believe, has been applied for during the past week. It is however better to be a vendor than an inventor.

MUGGINS' BRITISH-AMERICAN BROOM COMPANY, LIMITED.—The following letter was addressed to the Editor of the *City Press*:—

SIR,—The writer of the inclosed, who is an old friend of mine, having rather hurriedly determined upon making a prolonged visit to the Continent, has, in the kindest manner possible, allowed me to send it to you for publication. He says he hopes it may prove a useful warning to an easily-gulled public, in which pious wish, without at all understanding its application, I cordially concur.

I am, &c.,
AN OUTSIDER.

I have lately discovered a splendid way of making a lot of money, and with that reckless spirit of generosity for which I am so celebrated I hasten to communicate it to my old friend. The particular article with which I have been operating is brooms, but of course any other article in very large demand will do equally well. It appears, then, that there has lately sprung up a great demand for new brooms, whether because they are popularly thought to sweep clean, or for any other special reason, I know little and care less. That is nothing to me; the demand is sufficient for my purpose.

Having carefully considered my plan of action, this is how I proceeded. Seeing an advertisement from a well-known City institution asking for tenders for a very large supply of these most useful articles, I bought half-a-dozen of the very best I could procure, placed upon them a trade mark I had previously registered, sent them in as my sample, and offered to supply the very large quantity they required at considerably less than half the wholesale price. Of course my offer was eagerly accepted, and equally, of course, the reputation of Muggins' British-American Brooms was once established. I chose the name of Muggins because it sounds commercial, and British-American because it seems to combine the good qualities of both countries.

Having executed my order at a loss of a rather considerable sum, and got my remarkably low tender well advertised, I then took my next important step.

I got up a small company, to which I transferred the exclusive right to manufacture and sell my patent brooms in the counties of Middlesex and Surrey. By skilfully manipulating the shares on the Stock Exchange, and issuing but a small number to the public, I ran them up to a very large premium, and then my fortune was made.

We, that is to say, my four brother directors, my nephew the secretary, my brother-in-law the solicitor, and my cousin the broker, who had formed ourselves into "Muggins' British-American Broom Company (Limited)," were soon overwhelmed with applications for licences to form new companies in most of the important counties in England and Scotland, with exclusive right to manufacture and sell our brooms. They all paid us large sums of money for our concessions, which we immediately divided, and, strange though it may seem, it is nevertheless strictly true, that not one of them, up to the present time, has ever asked us a single question about the cost of our special article of manufacture, or the profit or loss attendant upon its production.

Our competitors shake their heads ominously, but that is attributed to jealousy, and so the work goes merrily on.

One good joke is that two or three other large City establishments have asked us to supply them on similar terms to our first tender, but our excuse was ready to hand: we had ceased to manufacture, having become simply licensors, so any further orders must be declined with thanks. We are told that imitation is the best form of flattery, and so I suppose I ought to feel highly flattered at the large number of people who talk of following out my original idea; but not caring to be merely one of a crowd instead of being, as I believe I am, a great originator, I have sold my shares at a large premium, and intend to indulge a fancy that has long possessed me of making an exhaustive tour in Spain.

We leave our readers to draw their own conclusions from this remarkable letter, *apropos* evidently of the electric light.

THE ELECTRIC RAILWAY BILL.—The Charing Cross and Waterloo Electric Railway Bill, which was declared not to have complied with the standing orders by the Lords' Examiner on a technical point, came on the 1st inst. before the Lords' Committee on Standing Orders. The defect having been remedied by the promoters, the Bill was declared to have complied with the standing orders.

THE COST OF ELECTRIC LIGHTING BY INCANDESCENCE.—The following letter appeared in the *Times* of the 5th inst.

TO THE EDITOR OF THE *Times*:—

Sir,—For more than six months I have had the principal reception rooms in this house almost exclusively lighted by incandescent electric lamps, the electricity being generated on the premises; and as so many different opinions have been given as to the expense of lighting by incandescent lamps, some saying that electricity is many times more expensive than gas, while others maintain that it is cheaper than gas, the results of my own private experience in electric lighting may not be without interest.

The dynamo machine—a small Bürgin—is driven by a 3½ horse-power "Otto" gas-engine, which in favourable circumstances will develop 5 horse-power. Owing to the absolute necessity which exists in a private house in this neighbourhood that there should be no smell of unconsumed gases and no noise of machinery either in the house or out in the street to annoy my neighbours, it became necessary to add silencing chambers to the air inlet and the exhaust pipe, and to carry the products of combustion high up on to the roof. The obstructions thus put in the way of the free working of the engine necessarily affect the horse-power, so that when a further deduction is made for the power absorbed in running the machinery when no electricity is being generated, I find I have not more than 2 horse-power available for the production of electricity. This is far from sufficient to drive the dynamo machine to its full power, therefore I lose greatly in efficiency both in the engine and the dynamo machine. However, I have only to deal with the facts as they show themselves in my experience. The total necessary expense of the installation has not exceeded £300, including wiring the house and making the lamps, although the actual expense to me has been much more, as I had to excavate and build underground rooms for the machinery. Where stables or out-buildings are available, or if a little noise is not prohibited, a less expense will give more available electricity, and

where steam-power can be used the cost will be diminished fourfold. The gas-engine requires five minutes' attention every day to fill the oil cups and start it. Once started, it will go on without attention for six or eight hours. It is overhauled and cleaned once a week; an engineer does this on a Saturday afternoon, at a cost of 2s. 6d.

The *maximum* electric current which I can get is 11·5 ampères through an external resistance of 12 ohms. The lamps fed by the current are distributed as follows:—In the library I have 11 20-candle lamps; in the dining room I have 10 20-candle lamps; in the drawing room I have a cluster of 21 4-candle lamps in an electrolier in the centre of the room and five 20-candle lamps. One or two lamps are in other parts of the house; the total number of lamps about the house being about 50. I cannot, however, have this number alight at once, as the machine as at present driven will not feed so many. It is, however, sufficient to light any two rooms perfectly, and the third partially.

Switches are placed in cupboards in each room, so as to turn any desired combination of lamps off and on. Main keys, cutting off the whole of the current at once, are placed in the engine-room, and also in my laboratory at the place whence the main wires diverge to the different rooms.

Owing to inexperience in adjusting the strength of the current to the kind of lamp used, and to the variety of systems, &c., I was then testing, the breakages during the first three months were somewhat numerous. For the last three months, however, since passing the experimental stage and settling down to a definite system, I have used lamps made by myself, and during this time only one lamp has gone.

The gas burnt in the engine when the machine is feeding its *maximum* number of lamps (22 20-candle lamps) is about 550 cubic feet in five hours, costing, at 3s. 2d. per thousand, 1s. 9d. Assuming that the light is required on an average five hours a night all the year round, this would come to £2 9s. a month, or £31 17s. per annum.

To obtain, not an equal amount of light, but a fairly good light from gas, to replace this amount of electric light, would take 30 gas-burners, each burning 5 ft. per hour, or 750 cubic feet in five hours, costing 2s. 4½d., or £3 6s. 6d. per month, or £43 4s. 6d. per annum.

The expenses, therefore, per month stand as follows:—Electricity.—Gas consumed in engine, £2 9s.; engineer once a week to clean and oil machinery, 10s.—£2 19s. Lighting by gas alone, £3 6s. 6d. Balance in favour of electricity per month, 7s. 6d.; or per annum, £4 17s. 6d.

I have here charged only the current expenses. Strictly speaking, I ought to charge interest and wear and tear, but these are more than counter-balanced by the incidental advantages of electric lighting. With it the ceilings do not get blackened, the curtains are not soiled with soot and smoke, the decorative paint work is not destroyed or the gilding tarnished, the bindings of books are not rotted, the air of the room remains cool and fresh and is not vitiated by the hot fumes from burnt or semi-burnt gas, while fire risk is almost annihilated, as no lucifers are used, and the lamps are high up out of reach.

In the above statement, I have compared electricity with gas as an illuminating agent. This is giving gas an unfair advantage. The 21 electric lamps in my drawing-room do not replace gas jets, but wax candles, while the incandescent lamps in the dining-room replace candles and oil lamps. The actual expense of these per night comes to three or four times the cost of electric illumination.

Moreover, I am producing my electricity at an extravagantly dear rate. The dynamo machine works only about half power, and this greatly reduces its efficiency; while Messrs. Crossley tell me that a consumption of over 100 ft. of gas per hour ought to give me double the power I get out of the engine; and doubtless it would do so were it not for the back pressure produced by the silencing boxes.

When electricity is laid on to our houses as gas is all these extra expenses and difficulties will disappear; and if, as I hope I have shown, electricity, heavily handicapped as it is in a private house, compares favourably with gas even in the matter of cost, it will necessarily be far cheaper than gas when it is supplied wholesale from a central station.

I am, &c.,

WILLIAM CROOKES.

7, Kensington Park Gardens, London, W., *June 1st.*

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TELEPHONE LITIGATION.—The London Globe Telephone Company have applied for an injunction to restrain the United Telephone Company from issuing damaging statements referring to the Hunnings transmitter. The case will come before Mr. Justice Fry in the Chancery Division on Thursday next.

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NEW WAY TO FLOAT COMPANIES.—The following, although apparently a private and friendly communication, has, we hear, been circulated amongst financial men in the City:—

2nd June, 1882.

DEAR SIR,—An important E——n company—a parent company—is about to be issued, probably early next week. The brokers of the company have been authorised to place in advance a certain number of shares, which will be allotted in full. The greater part of these have already been taken, and it may be that by the time this reaches you, all have been taken; but should that not be the case, and should you desire to secure any of them, you may be able to do so through applying to Messrs. A. A. & Co., whom I have requested to do all in their power to meet your wishes in the matter.—Yours sincerely,

G. E. G.

The full names are omitted. Smart tactics these.

TELEGRAPHS IN CHINA.—In *Nature* of the 1st inst. we read as follows: We are glad to observe that the telegraph is making rapid way in China. The Shanghai-Tientsin line has been working now for a few months, and a line is being constructed in the South between Canton and Hong-Kong—a distance of about 100 miles. The first section is to connect Canton, which is practically the commercial capital of China, with the frontier of British Kowloon, situated opposite the town of Victoria. After some consideration it has been decided that a land-line is preferable to a submarine cable, as it will be more economical, and the latter also would seriously interfere with the enormous junk traffic and fishing operations in the estuary of the Canton River. It is interesting to remark that this line is purely a private undertaking of a company of Chinese merchants in Canton, who, doubtless, want to be on a level with their brethren in the North in rapidity of communication with the markets of the world. The line, as above stated, will for the present terminate on the confines of British territory. It seems hardly credible—but the fact is stated in the Hong-Kong journals—that opposition is made by the British authorities to the further construction of the line, and especially to the cable across the harbour, necessary to connect Hong-Kong with Kowloon, unless it is constructed by a British company.

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ELECTRICITY *v.* GAS.—The following letter was addressed to the editor of the *Times* on the 29th ult., by Mr. C. M'L. M'Hardy:—

SIR,—At the present time, when the above question is occupying so much attention, the following *data* may interest your readers and assist in an elucidation of the subject. Electricity costs about one farthing per lamp of from 19 to 20 candle-power, as will be seen from the following. One horse-power will generate electricity to keep incandescent 8 to 10 lamps, giving from 16 to 20 candle-power each. One horse-power consumes from 2½lb. to 3lb. of coal per hour. Two thousand lamps would, therefore, require from 4½cwt. to 7cwt. of coal per hour, which, at 15s. per ton, will amount to 3s. 4½d. or 5s. 3d. per hour, according as we take the more favourable or unfavourable expenditure. The cost for the installation and for the annual maintenance for 2,000 lamps of from 16 to 20 candle-power each will be approximately as follows:—

| | Installation. | Depreciation or Cost of Maintaining. | |
|---|---|---|---|
| Building ... ... | £200 | at 3 per cent. | £6 |
| 200 H.-P. Engine | 1,000 | at 5 per cent. | 50 |
| Boilers and Furnace | 500 | at 7 per cent. | 35 |
| Dynamo Machines | 1,000 to 2,000 | at 2 per cent. | 20 to 40 |
| Leads and Fittings for 2,000 Lamps, exclusive of Lamps | 1,500 | at 2 per cent. | 30 |
| | £4,200 to £5,200 | | £141 to £181 |
| | say £5,500 at £200 per annum. | | |

Lamps lighted at dusk and extinguished at midnight will be burning 2,000 hours per annum, and the annual cost will be as follows:—Interest at 5 per cent., £275; replacement, &c., £1,200; replacement of lamps, £1,000; coal, £500; engine-driver, £100; stoker, £50; electrician, £150; rent of premises, £100; sundries, £125; total, £2,500 per annum; that is to say, including 5 per cent. interest on the capital invested, the cost per annum of 2,000 lamps, giving from 16 to 20 candle-power will be £2,500, or 25s. per lamp per annum for 2,000 hours. Twenty-five shillings, or 300 pence, for 2,000 lamps for one hour, is 30 pence for 200 lamps for one hour, or about 1d. per lamp for seven hours.

Gas costs one farthing per lamp of six to eight candle-power per hour, as will be seen from the following:—One thousand feet gas, at 4s. 2d. equals 50d. per 1,000, or 1d. for 20 ft.; 1,000 ft. gas at 3s. 4d. equals 40d. per 1,000, or 1d. for 25 ft. An ordinary burner consumes from 5 ft. to 8 ft. per hour, or at a cost of one farthing for a lamp of from six to eight candle-power.

In the letter from the engineer of the Siemens' Patent Gas Light Company, Limited, which appeared in *The Times* of the 20th inst., he states that they have in the street at Holborn 22 lamps, of 130 candle-power, burning 24 cubic feet per hour, and one lamp of 330 candle-power burning 55 cubic feet per hour. A simple calculation shows that these 23 lamps give 3,190 candle-power, with a consumption of 583 feet of gas per hour, which, at the moderate price of 3s. 4d. per 1,000 ft., would cost a fraction over 1s. 11d., say, 2s. per hour.

To compare the cost of this with the electric incandescent light the cost of the same candle-power should be taken—say, 200 lamps of 16 to 20 candle-power, which would give a total of from 3,200 to 4,000 candle-power. From the foregoing statement it will be seen that the cost for the 200 incandescent lamps, giving from 3,200 to 4,000 candle-power, will be about 2s. 6d. per hour.

Stated shortly, the cost per hour appears to be as follows, taking the gas at 3s. 4d. per 1,000 ft.:—30d. for 200 electric incandescent lamps giving 3,200 to 4,000 candle-power; 24d. for 23 Siemens' gas lamps, giving 3,190 candle-power; 40d. for 140 ordinary fish-tail

gas lamps, giving 1,083 candle-power: 40d. for 200 Sugg's Christiana flat flame, giving 3,000 candle-power.

In considering the foregoing *data* the two following important facts should be borne in mind in favour of electricity:—First, in the cost for electricity the whole of the lamps, fittings, &c., are included, whereas with gas the consumers are supplied with the gas, but have to provide themselves with fittings, such as gas brackets, globes, &c.; second, the foregoing calculations are based on the assumption that the plant for generating the electricity cannot be utilised for quite six out of every twenty-four hours, whereas, by the adoption of secondary batteries (better known as accumulators, or storage batteries), by a comparatively trifling additional outlay, the same engines, boilers, dynamos, &c., may be utilised for about three to four times as many lamps, and so considerably reduce the cost.

Moreover, the foregoing figures in regard to electric lighting have reference only to the use of the incandescent lamp, because the arc lamp can scarcely be considered suitable for use in private houses, however suitable it may prove to be for streets, public buildings, factories, &c. While about 200 candle-power per horse-power is the light that can at present be obtained with incandescent lamps, there is no difficulty in obtaining from 1,000 to 1,200 candle-power per horse-power with the arc lamp.

Mr. M'Hardy's letter has brought forth the following response from a gas engineer:—

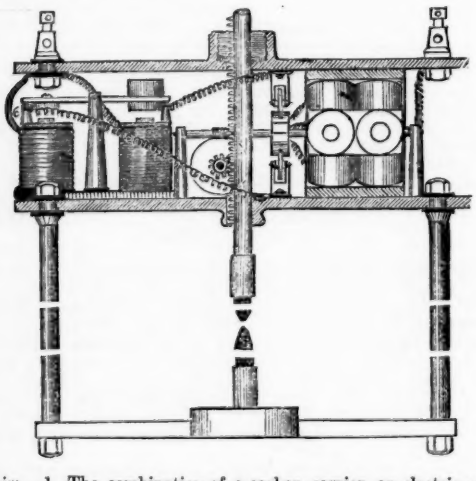
*To the Editor of the* TIMES.

SIR,—There is a material error in Mr. Hardy's letter appearing in the *Times* of the 2nd inst., which please allow me to correct.

Mr. Hardy bases his calculations on the supposition that electric lamps will be used for 2,000 hours per annum. I am convinced that 1,000 hours would be in excess of their actual duration; in proof of which I may mention that in Leeds there are at least 10,000 consumers of gas whose annual payments do not exceed 10s., which would be the return for a single light (*i.e.*, 15 candles) burning 1,000 hours. Further, we have 60,000 customers, including many large railway stations and factories, yet our gross sale only averages 20,000 ft. per customer (less than 40s. per annum), which, supposing lights were required for 2,000 hours, would give an average of only two lights per customer throughout the borough. If Mr. Hardy will accept the *data* here given, he must declare the cost of incandescent lighting to be almost double what he has calculated it to be.—I am, yours faithfully,

HENRY WOODALL,
Gas Engineer to the Leeds Corporation.

ELECTRIC LIGHT REGULATOR.—Patent 257,588, filed in the United States of America Patent Office, July 27th, 1881, by Nathaniel S. Keith.



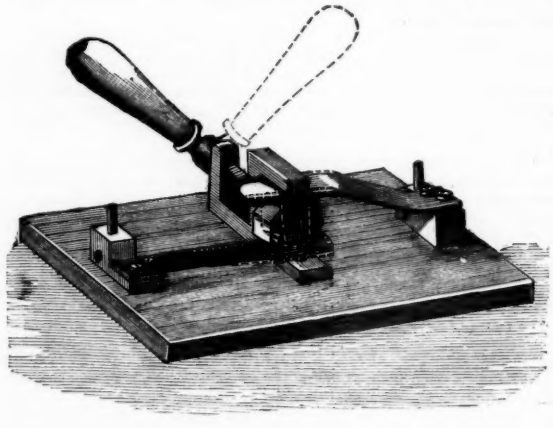
*Claim.*—1. The combination of a carbon-carrier, an electric-motor gearing with said carrier, so as to control its movement in both directions, said motor being placed in a derived or branch circuit, devices, substantially as described, for reversing the direction of movement of that portion of the motor-train which engages with the carrier, and two regulating or controlling electro-magnets operating said reversing devices, one of said magnets being placed in a derived circuit to the carbons and the other in the main or principal circuit with said carbons.

6. The combination, substantially as described, of a carbon-carrier, an electro-magnetic motor in a derived circuit, provided with independent commutator brushes or collectors, and a pivoted armature-lever, main and derived circuit electro-magnets acting upon said lever, and circuit-connections, as described, the whole so arranged that when the attraction of the main-circuit magnet preponderates the circuit of the motor is closed through one of the collectors and the motor revolves in one direction, while, *vice versâ*, when the attraction of the derived-circuit magnet preponderates the circuit is closed through the other collector and the motor revolves in the opposite direction.

The six claims for this patent are worded in so nearly the same language that it is only necessary to give the first and last in order to clearly understand the method of regulation adopted in this lamp.

THE ELECTRIC LIGHT IN THEATRES.—On Monday, the 29th ult., Mr. F. Emery, the lessee of the Prince of Wales' Theatre, Liverpool, caused the whole of the auditorium to be illuminated by means of the Maxim electric light. The experiment was a complete success. The temperature of the theatre was noticeably lower than usual. The electric light will be henceforth adopted at this house.

CONTACT MAKER FOR ELECTRIC LIGHT CIRCUITS.—We illustrate a strong and simple contact maker, designed by Mr. Eidsforth, the well-known manager of Mr. E. J. Paterson, of St. Paul's Works, Little Britain, E.C. It will be seen that good contact is doubly insured in this little instrument, both the inside and outside faces of the contact-springs being in metallic connection when the handle is thrown over. We feel sure that this extra safe method of forming a good contact will meet with the approval of electric light engineers.



ELECTRICITY FROM NIAGARA.—The scheme for utilising the water power of Niagara Falls in generating electricity, to be conducted to various cities and towns, has been revived by Leonard Henkle, of Rochester. He claims to have an agreement for the sale to him and those associated with him of Prospect Park, at the Falls, for 1,000,000 dollars, and to possess some mysterious inventions of generating electricity by this enormous hydraulic force, estimated at 2,000,000 horse-power, and he states that the electricity will be conveyed through "10,000 miles of properly insulated cables to 65 prominent cities and towns between Boston and Chicago." Mr. Edison was asked how far he thought the power could be successfully carried, and replied:

"At present I think it would be a commercial success to take the power from the Falls to Buffalo. Now it is scientifically possible, if a 10 horse-power engine be placed at the Falls, to transmit a force of 9 9-10 horse-power to New Orleans. But looking at the practical working, the thing is an absurdity. To carry this electricity a long distance there must be large cables and such an expense that it wouldn't pay; it would be very much cheaper to depend upon the local power of steam engines. Suppose for a given sum electricity could be carried 50 miles. You want to carry it 100 miles, but don't wish to double the expenses of the plant. Then the intensity and pressure must be so increased that it would be impossible to work the machines on account of the danger, and the electricity could not be kept on the wires. I could take water from above Albany and force it through an inch pipe to New York if the pipe would stand it, and if I had a pressure of, say, 30 miles high. Electricity can be carried theoretically at an enormous pressure, but practically it cannot be kept on the wires, nor can the machines be handled. Just consider, too, the question of cost. This man says he will have 10,000 miles of cable. The Atlantic cable cost 4,500 dollars a mile, and the wire in this cable is smaller than that in ordinary use. It is run, too, at a very low pressure. We use 20,000 times the pressure used in this cable. But on this exceedingly insufficient basis there is an item of 15,000,000 dollars for cables alone. But I fancy

Mr. Henkle takes only a sentimental interest in this plan. He is a wild talker, and it is as easy for him to talk of millions as cents. The thing is really too impracticable and absurd to be taken seriously."—*New York Tribune.*

THE POSTMASTER-GENERAL AND THE TELEGRAPHISTS.—The following correspondence has taken place on this subject:—"House of Commons, May 22.—Dear Mr. Fawcett,—You have bestowed so much attention on the efficient working of the Post-office that I need make no apology for bringing under your notice the claims of certain telegraphists who are employed in various parts of the country. You have expressed a desire to see arrangements carried out in the Post-office that will insure 'a cheerful service.' On public grounds it is very desirable that this result should be attained, especially in the telegraph department. I have, during the last quarter of a century, paid large sums annually for telegrams, and I am personally acquainted with the results attained under the old companies, and since the lines were taken over by the Government. My experience leads me to the conclusion that the retention of efficient telegraphists is a matter of great public importance. It is to be feared that if the dissatisfaction which continues to prevail among the best class of telegraphists be permitted to continue the Post-office will ultimately lose the services of many highly-trained men, who might be retained without incurring any large expenditure. Among the 6,000 telegraph clerks in the United Kingdom there are from 600 to 700 pre-transfer men, whose claims to special consideration are worthy of careful examination. I believe that the utmost these pre-transfer men have asked for is to be placed on the same conditions as Post-office clerks. I have been requested to bring this matter before you, and I do so on public grounds, believing that the satisfaction of the claims of the pre-transfer telegraphists—who joined the Post-office under distinct promises—would prove advantageous to the public, and especially to all who have occasion in their business to make use of the telegraph to a large extent. I think you have intimated that the arrangements you have in contemplation with regard to the telegraph service are not yet complete, and as the pre-transfer clerks believe that they have made out a good case for your consideration, it would be a real satisfaction to them if you could inform them that their claims will be included in any further investigation that may be made into the condition of the telegraph staff.—I have the honour to remain, yours very faithfully, P. STEWART MACLIVER.—Right Hon. Henry Fawcett, M.P."

"General Post Office, May 25.—Dear Mr. Macliver,—I am much obliged to you for your letter of the 22nd inst., and I am sure that you fully appreciate the difficulty of the task which I had to perform in discriminating between the legitimate and the illegitimate claims of the telegraphists. No pains have been spared to accomplish this end, and, although I know that no arrangement can be devised which would satisfy everybody, I feel confident that the settlement of last year fully meets the justice of the case. Under these circumstances I cannot consent to re-open the question. I believe there is no ground for the fear you express that the department will lose the services of many of the best telegraphists, as in several instances telegraphists who have lately left have earnestly entreated to be permitted to re-enter the service.—Believe me, yours very truly, HENRY FAWCETT.—P. Stewart Macliver, Esq., M.P." Respecting this correspondence between the two gentlemen above-named, the following letter appeared in the *Times* of Thursday last:—

Sir,—In *The Times* of last Thursday there appeared a letter from the Postmaster-General to Mr. Macliver, M.P., in which he says that he feels confident that the settlement of last year fully meets the justice of our case, and, therefore, he cannot consent to reopen the question. Since Mr. Fawcett declines to consider grievances under his new scheme which are set forth in memorials from all parts of the country, and since a statement of his to the effect that our just grievances have been removed has been made public through the medium of *The Times*, it is evident that the telegraphists have no alternative but to make known to the public a few unvarnished facts, showing how far one is justified in thinking our case has been fully met. With this object, therefore, I beg to ask you if you will kindly allow me space for a few lines in *The Times*.

In the first place, many clerks with from nine to eleven years' service who had been at a standstill at the maximum of their class at £65 per annum from two to five years were accorded only a £5 increment under the new scheme, with a certainty of reaching after another six years' service the liberal salary of £100 per annum. They will then once more be at the maximum of their class, and, judging from our past experience, we may be reasonably certain that some of them will have spent twenty years of their lives in the service before they receive a higher salary.

While rendering it impossible for men who have already served so long to receive £100 per annum until after they have served from fifteen to seventeen years, the Postmaster-General has been careful to assure to all future entrants the receipt of that salary after thirteen years' service.

In the face of this, we ask—has justice been done to the nine to eleven years' service men of the present day?

I am, Sir, yours faithfully, ORSON.

## NEW COMPANIES REGISTERED.

BRITISH INDIAN ELECTRIC LIGHT AND POWER COMPANY, LIMITED.—Capital £250,000, in £5 shares. Office, 5, Austin Friars. Objects: To acquire and work the patented inventions of the Electric Light and Power Generator Company, Limited, in British India. Signatories:—*Admiral E. A. Inglefield, 99, Queensgate; *G. Inverarity, 13, Stanhope Gardens; R. C. Cannon, 2, St. John's Villas, Richmond; M. Low, 22, Rowland Gardens; H. T. McNeale, 8, Elm Park Gardens, S.W.; G. A. Thomson, 13, Austin Friars, 50 shares each, and F. Goodrich, 90, Gibbon Road, Nunhead, one share. Directing qualification, 50 shares. General Sir Michael Kennedy, R.E., and Worsley Roberts, Esq., are members of the board. Remuneration, £1,750 per annum and 10 per cent. of the profits remaining after payment of 10 per cent. dividend. Registered 31st ult. by Lyne and Holman, 5 and 6, Great Winchester Street.

ELECTRICAL SHARE TRUST, LIMITED.—Capital £500,000, in £5 shares. Objects: To invest capital in the securities of electric light and power or kindred companies, or in gas and water works, docks, tramways, railways, and similar undertakings. Signatories:—General H. C. Johnstone, C.B., 13, Aldridge Road, W.; H. Watt, 93, Leadenhall Street; A. J. Atkey, 33, Cornhill; W. A. Harris, M.D., 78, Oxford Gardens; T. R. Amott, F.R.C.S., 38, King William Street; F. Friend, 11, King William Street, 40 shares each; E. M. Prothero, Mortlake, 10 shares. The signatories nominate the first directors; qualification, 40 shares; remuneration, £2,000 per annum. Registered 1st inst., by Hepburn, Sons, and Co., 76, Cheapside.

ALBION ELECTRIC LAMP COMPANY, LIMITED.—Capital £10,000, in £10 shares. Objects: To purchase from Mr. John Jameson, the right to one-half of the profits gained on account of the letters-patent No. 4,439 of 1881, relating to improvements in the manufacture of incandescent electric lamps. Signatories (with one share each): N. T. Cookson, G. J. Cookson, H. T. Cookson, and J. Jameson, of Newcastle-on-Tyne, and G. Davidson, T. Davidson, and L. H. Armond, of Gateshead. Registered 31st ult. by Charles Doubble, 14, Serjeants' Inn, Fleet Street. Solicitors, Arnott and Swann, Newcastle-on-Tyne.

W. T. HENLEY'S ELECTRIC LIGHT AND POWER COMPANY, LIMITED.—Capital £100,000, in £1 shares. Objects: To acquire and work the letters-patent of Mr. W. T. Henley for the production of electric light and power. Signatories (with one share each): *Morgan Lloyd, Q.C., 53, Cornwall Gardens; *F. A. Fane, 55, New Bond Street; *R. Hewitt, Esher; *F. Newton, 16, King William Street; W. T. Henley, North Woolwich; J. Duncan, 53, Tavistock Road; W. J. Wilkinson, 9, Campden Grove, Kensington. Directing qualification, 500 shares. Lord Headley and Mr. C. Kemp Dyer are members of the first board. Remuneration, £400 per annum to the Chairman and £200 per annum to each ordinary director. £100 for every 1 per cent. dividend beyond 6 per cent. will be divided amongst the directors. Registered 2nd inst. by Newman & Co., 8, Draper's Gardens.

ELECTRIC LIGHTING SUPPLY AND FITTING COMPANY, LIMITED.—Capital £20,000, in £10 shares. Office: Victoria Mansions, Victoria Street, S.W. Objects: To carry on business as electricians, mechanical and general engineers. Signatories (who with one exception subscribe for 25 shares each): E. Hopkins, 3, Upper Berkeley Street; P. Keith, 13, Leadenhall Street; P. M. Collier, 23, Rood Lane; E. Mellor, 2, Harcourt Buildings, Temple; N. Tapp, 4, Great George Street (1 share); W. Russell, 5, Westminster Chambers, S.W.; S. H. Burbury, 1, New Square, Lincoln's Inn. Registered 2nd inst. by Goodhart and Medcalf, 11, Great George Street.

UNITED KINGDOM ECONOMIC ELECTRIC LIGHT AND POWER COMPANY, LIMITED.—Capital £500,000, in £5 shares. Objects: The business of an electric light and power company in all branches. Signatories (with one share each): W. W. Rollisson, South Wimbledon; J. H. Martin, 10, Hereford Road, Bayswater; F. Stone, Manor Park, Essex; J. J. Heath, Stamford Hill; T. R. Rollisson, 80, Clapham Road; E. Hirschhorn, 11, Old Jewry Chambers; H. F. Bates, Twickenham. Directing qualification twenty shares. Remuneration, £300 per annum to the chairman, and £200 each ordinary director. Registered 2nd inst. by Cridge & Bell, 26, Bishopsgate Street Within.

"MARKLAND" ELECTRIC LIGHTING, POWER, AND REGULATOR COMPANY, LIMITED.—Capital £200,000, in £1 shares. Objects: To purchase and work the letters-patent of 1881, No. 3,679, for improvements in electric light regulators. Signatories (with one share each): *J. S. Smith, South Hornsey; *F. W. Petrie, Upton, Essex; *Hy. Clifford, Hammersmith; *A. H. Rowe, 35, Victoria Street; *J. S. Ullathorne, C.E., Hammersmith; *R. Scovell, 39, Osborne Road, Forest Gate; *G. B. Walker, 43, British Street, Bow. Directors' remuneration, £1,500 per annum, and an additional £100 for each one per cent. dividend beyond ten per cent. per annum. Registered 6th inst. by Fowler & Co., Victoria Mansions.

* Signatories whose names are preceded by an asterisk are also directors.

## NEW PATENTS—1882.

2526. "Dynamo or magneto-electric machines (increasing, &c., current to suit one or more lights"). W. R. LAKE. (Communicated by J. J. Wood.) Dated May 27. (*Complete.*)

2560. "Improvements in and connected with electric lamps and in electrodes therefor." S. HALLETT. Dated May 31.

2562. "Improvements in hair-brushing by electricity, which improvements are applicable to other purposes." R. F. HENEY. Dated May 31.

2563. "Electric lamps or lighting apparatus." W. R. LAKE. (Communicated by J. J. Wood.) (*Complete.*) Dated May 31st.

2565. "Dynamo-electric machines." A. J. JARMAN. Dated May 31.

2567. "Improvements in heating by electricity and in apparatus therefor. O. ROSE. Dated May 31.

2569. "Electric lamps." T. E. GATEHOUSE and H. R. KEMPE. Dated May 31.

2570. "Electric lamps or lighting apparatus." W. R LAKE. (Communicated by J. J. Wood.) Dated May 31. (*Complete.*)

2571. "Improved method or means of making the insulating bodies of electric light conducting wires noninflammable." W. A. and S. E. PHILLIPS. Dated May 31.

2573. "A new or improved dynamo-electric machine, certain improvements whereof are applicable to and in the construction of dynamo-electric machines generally." S. HALLETT. Dated May 31.

2578. "Telephonic instruments." S. P. THOMPSON. Dated May 31.

2595. "Preparing certain materials for use in secondary electric batteries." W. BOGGETT. Dated June 1.

2602. "Secondary batteries or apparatus for storing electricity." Sir C. T. BRIGHT. Dated June 2.

2604. "Incandescent electric lamps." F. DES VŒUX. (Communicated by A. Bernstein.) Dated June 2.

2613. "Electric lamps." W. E. AYRTON and J. PERRY. Dated June 3.

2618. "Dynamo - electric machines." R. E. B. CROMPTON. Dated June 3.

2619. "Electric lighting." R. E. B. CROMPTON. Dated June 3.

2622. "Application of electricity for the protection of property and the detection and prevention of robbery." E. L. MISSONNIER. Dated June 3.

2623. "Devices for coupling or connecting the armatures and commutators of magneto or dynamo-electric machines." W. R. LAKE. (Communicated by J. J. Wood.) Dated June 3. (*Complete.*)

2628. "Apparatus for transmitting and collecting electric fluid generated by magnetic metals or ores, to illuminate or work machinery." H. DEFTY. Dated June 5.

2629. "Intensifying fluorescent or phosphorescent electric lighting, whereby the same is rendered serviceable for illuminating purposes or means for effecting the said intensification." R. KENNEDY. Dated June 5.

2632. "Electric lamps or lighting apparatus." W. R. LAKE. (Communicated by J. J. Wood.) Dated June 5. (*Complete.*)

2636. "Dynamo-electric, magneto-electric, and electro-magnetic machines, also applicable as electro-motors." A. L. FYFE and J. MAIN. Dated June 5.

2641. "An improved system and arrangement of telephonic communicators for use as fire-alarms or for analogous purposes." A. W. ROSE. Dated June 5.

2642. "Contrivances for registering the amount of work given electrically to any part of an electric circuit in a given time." W. E. AYRTON and J. PERRY. Dated June 5.

2643. "Construction and arranging of secondary batteries or apparatus for effecting electrical storage and means or apparatus for charging and recharging such batteries." H. WOODWARD. Dated June 6.

2644. "Underground electrical conductors." L. VARICAS. (Communicated by G. Richardson.) Dated June 6. (*Complete.*)

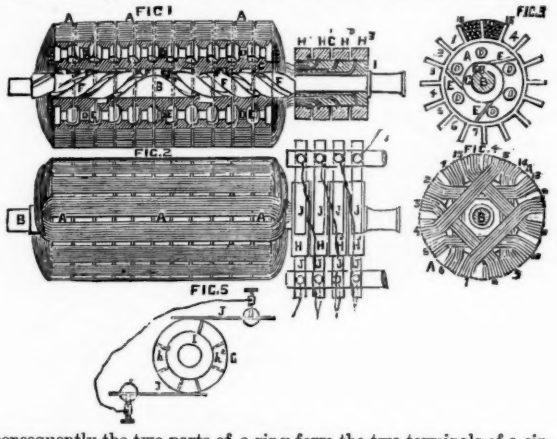
2654. "Electric lighting." R. J. HATTON and A. L. PAUL. Dated June 6.

2658. "Manufacture of secondary batteries." A MUIRHEAD. Dated June 6.

2659. "Primary and secondary batteries and mode of and apparatus for applying such and other secondary batteries to lighting, power, heating, and other purposes." W. B. BRAIN. Dated June 6.

## ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1881.

4559. "Apparatus for generating and utilising electricity." F. M. NEWTON. Dated October 19. 6d. Has for its object improvements in apparatus for generating and utilising electricity. Fig. 1 is a central longitudinal section of an armature, according to the invention, suitable for a magneto-electric, an electro-magnetic, or a dynamo-electric generator, or for an electric-motor. Fig. 2 is a plan of the same; fig. 3 is a cross section, and fig. 4 an end view; fig. 5 shows in end elevation one form of commutator employed. A, A, are a number of discs of wrought or cast iron threaded upon a central shaft or spindle, B. Each disc is wider at its boss, C, than at its other parts, and consequently a space for the circulation of air is left between each pair of adjoining discs. Non-conducting washers may be interposed between the bosses, C, C, to prevent the circulation of currents in them, if found desirable. Each disc is pierced with holes, D, and is provided with one or more blades or wings, E, to cause the outward circulation of air drawn in through the holes, D, and through helical grooves, F, F, in the shaft and bosses of the disc. Right and left-handed grooves are provided, so that the air can enter from both ends. Upon the periphery of each disc is a series of grooves or notches, numbered 1 to 16, and the discs are so arranged on the shaft that these notches coincide and form sixteen longitudinal grooves, broken at short intervals by the spaces between the discs through which constant streams of air are thrown out by centrifugal force. In these grooves eight coils of insulated wire are wound (as shown) in the order described above (in which description the numbers applied to the grooves are the same as in the drawing), and the coils constituting each parallel pair are joined together to form one electrical circuit. Thus the eight coils constitute four circuits. G is the commutator, consisting of four metallic rings, H, $H^1$, $H^2$, $H^3$, mounted upon a non-conducting cylinder, I, on the shaft. There is one ring for each circuit on the armature, and each ring is divided into two parts or segments, $h^1$, $h^2$, whereof $h^1$ constitutes five-eights or thereabouts of the ring, and $h^2$ three-eighths or thereabouts. One end of each circuit is attached to one part or segment of a ring, and the other end to the other part of the same ring,




consequently the two parts of a ring form the two terminals of a circuit. Each ring runs in contact with two contact strips or brushes, J, J, which bear upon it at the opposite ends of a diameter, and which are so placed with relation to the ring that when the coils are passing through that part of the magnetic field in which but little or no current is generated (hereinbefore called the neutral part), both brushes bear upon one part of the ring, and a short circuit is made between them through that part of the ring, while the end of the coil which is attached to the part, $h^2$, of the ring, is insulated and the resistance of the coil is cut out of the general circuit. The divisions between the parts, $h^1$ and $h^2$, of the rings are shown in the figures as parallel to the axis, but to moderate the sparks which occur as the contact pieces or brushes cross the divisions between the two parts, it is convenient to make these divisions inclined to the axis, so as to make the changes more gradual. When, however, the junction is made very oblique, the brushes make contact with the two parts, $h^1$, $h^2$, at the same time, and then both the two ends of the coil and the two brushes are put in direct connection. The invention also refers to an electric arc lamp.

4592. "Apparatus for generating electricity, &c." A. MILLAR. Dated October 20. 8d. Relates to improvements in the construction or arrangement and combination of the parts and in the operation of magneto-electric machines and electro-motors or apparatus for the generation of electric currents, and for the production of motive-power therefrom, part of the improvements being also applicable in connection with means for transmitting electricity; and the main objects of the invention are to enable electric currents to be produced with less expenditure of mechanical power than heretofore, and to obtain electromotive power by means of more perfect and effective machines or apparatus, while also providing against loss of current in transmission through wires or other conducting media. The first part of the invention comprises an improved construction or arrangement and combination of the parts of a magneto-electric machine, which consists of a disc or circular plate of bronze or other non-magnetic metal resting on the sides of a cylindrical tank or cistern. A series of six or other number of permanent magnets is arranged in a circle concentric with the disc, and have their poles terminating in pieces of soft iron, which are inserted into the disc, and have their upper surfaces level with the upper surface of the disc. A series of six or other equal corresponding number of electro-magnets is arranged in a second circle exterior to and concentric with the circle of permanent magnets. These terminate in pieces of soft iron similar to the terminal pieces of the permanent magnets, and both sets of soft iron terminal pieces are shaped so as to form segments of the circles in which they are placed. A series of soft iron rollers, in number one less than the corresponding number of either series of magnets, rest on the surface of the disc and are made to traverse a circular path on the surface of the disc by the rotation of an axis carrying the arms, which have forked pieces in which the trunnions of the rollers rotate. The length of the rollers is considerably greater than the space which separates the two circles of segments, so that they roll upon and form connecting bars to each pair of segments as they pass over them. The axis of the arms carrying the rollers works between suitable bearings and carries a pulley to which rotary motion is given by a belt driven by a steam engine or other motor.

4748. "Galvanic or electric batteries." W. R. LAKE. (A communication from abroad by Joseph François Aymonnet, of Grignon, France.) Dated October 29. 6d. Relates to an improved electrical or galvanic battery in which only one liquid is used, and which may be employed for producing light, heat, and power, also for the electro deposition of metals. This battery may have one or more elements, and each element has for its negative pole a piece more or less pure of iron or other metal, such as manganese or chromium, or an alloy of such metals, and for its positive pole a piece of coke or the like, or of platinum more or less pure. These poles may be made in any suitable form, and may be divided as desired. The liquid in which these poles are to be immersed consists of a mixture of two aqueous solutions, one of which contains chlorine or hydrochloric acid, or a chloride or a mixture of these substances. The other solution contains nitric acid or a nitrate or chromic acid, or a chromate or a bi-chromate or bi-oxide of manganese or sesqui-oxide of iron, or a sesqui-chloride, or a bi-chloride, or a mixture of these substances.

4778. "Electric lamps." F. WRIGHT. Dated November 1. 2d. Relates to a construction of incandescent electric lamps, whereby the inventor greatly simplifies their manufacture and increases their durability. A suitably prepared carbon fibre is inclosed within a glass globe, which is made with an elongated bottle neck that is reduced to a smaller diameter near its end, and is finally at its end flattened in one direction so as to present sufficient breadth for the passage through it of the wires connecting to the ends of the filament. These wires where they pass through the glass end of the neck are short pieces of platinum sealed into the glass. From these wires of copper or other metal brazed to the platinum wires extend nearly to the points of attachment of the fibre, and to these again are brazed short pieces of platinum wire which are connected to the two ends of the fibre. In the shoulder of the bottle neck where it is reduced in diameter there is provided a small obliquely projecting glass tube for the purpose of exhausing the lamp, this tube being sealed after exhaustion. (*Provisional only.*)

4792. "Apparatus for closing the circuit on the extinction of an electric lamp, &c." W. E. HUBBLE. (A communication from abroad by Jean Marie Anatole Gérard-Lescuyer, of Paris.) Dated November 2. 6d. Relates to apparatus to be employed in connection with electric lamps for the purpose of automatically closing the circuit when any lamp becomes accidentally extinguished, and it consists in the employment of an automatc apparatus, which is applied to each lamp, and is so constructed that when the circuit is interrupted by the failure of a lamp, the current is caused to pass along another path, and thus by the intervention of combustible or fusible connections, or by exciting or demagnetising electro-magnets acting upon rods dipping into cups of mercury or other suitable contact makers automatically closes the circuit, so that the extinction of any lamp provided with this apparatus cannot in any way interfere with the working of the other lamps placed on the same circuit.

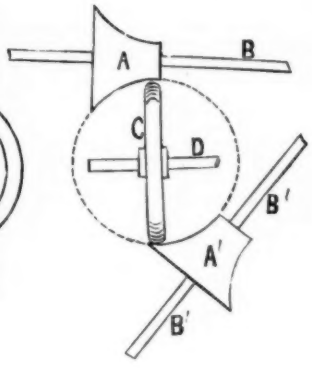
4797. "Telegraphic or telephonic cables and conductors." C. L. GORE. Dated November 2. 6d. Relates to the insulation of telegraphic or telephonic wires or conductors, and is designed to provide means whereby such wires or conductors formed into bundles, masses, or cables may be effectively insulated one from another at a much smaller cost; and whereby the separate wires may be caused to lie considerably nearer to one another than is possible with any of the methods heretofore in use, thus permitting a considerable diminution in the thickness of the bundle, mass, or cable. According to this invention each wire is provided with a number of rings or otherwise formed pieces of insulating material, that is to say, material which is a non-conductor of electricity, these rings or pieces being secured upon the wires at suitable intervals apart in such a manner that they will keep an adjacent wire at a sufficient distance to insure insulation.

4812. "Apparatus for using electric lamps on locomotives, &c." H. J. HADDAN. (A communication from abroad by Wauters de Busscher, of Brussels.) Dated November 3. 2d. Relates to the use of electric lamps on locomotives and other vehicles. It consists in attaching an electric lamp with movable reflector to the funnel or other convenient part of a locomotive or other vehicle, and supplying the necessary electric current in the following manner:—The reflector is hinged or otherwise made adjustable and controlled by the driver, so as to throw the light in the desired direction. The motive-power for driving the dynamo-electric machine carried by the vehicle is taken from one of the locomotive axles by means of a belt which moves a horizontal shaft, on which is mounted a friction wheel provided with an india-rubber tyre, and driving a smaller friction wheel mounted on the driving shaft of the dynamo machine, and capable of being set in or out of gear. (*Provisional only.*)

4824. "Electric-current meters." C. A. CARUS-WILSON. Dated November 3. 6d. The object of this invention is to register automatically the amount of electricity which passes through a wire or conductor. The invention consists mainly of a peculiar method of obtaining a variable rotation of one shaft from another shaft rotating with a constant angular velocity; and, secondly, of means by which the piece connecting the one shaft with the other is moved in accordance with variations in the current to be measured. For the purpose of obtaining a variable rotation of one shaft from another shaft rotating with a constant angular velocity, two cones are employed, as represented at A, A¹, in plan in fig. 1, and in elevation in fig. 2, whose generating surfaces are segments of one and the same circle. These cones are keyed respectively on two shafts, B, B¹, which are placed in the same horizontal plane in such a way that the contours of the two cones in plan form parts of the circumference of the circle (represented dotted in the figure), of which the generating lines of the two cones are segments. The cones are also placed so that their ends of smaller diameter point the same way, and should be of such a size as regards length of generating surface that they form equal segments of the same circumference, but this is not essential. A wheel, C, of diameter equal to or greater than the diameter of the above-mentioned circle is placed vertically between the two cones, A and A¹, so that its circumference is in a plane at right angles to the plane containing the axis of the two cones, and its axis, D, is in a plane parallel to the above plane, below it, above it, or

FIG. 2.

FIG. 1.




actually coinciding with it. It will follow from this, that if the circumference of the wheel, C, is made to touch the two cones, A, A¹, the tangent at each of the two touching points will be a tangent common to the wheel and to the cone, and hence if the three axes are thus fixed, any rotation of the one cone will be communicated to the other, provided there is sufficient friction, and that if one cone has a constant angular velocity, the other cone will have an angular velocity depending upon the angle which the axis of the wheel makes in plan with the axis of either cone, and upon the actual relative sizes of the cones themselves. This action constitutes an essential feature of the invention. The variation of the above-mentioned angle can be produced in several ways, by mechanical motion derived from variations in the current to be measured.

4850. "Carbons for electric lighting." C. J. ALLPORT and ROBERT PUNSHON. Dated November 5. 2d. The object of the invention is to produce an improved form of carbon suitable for incandescent electric lamps, made by a film or covering of carbon on an asbestos cord or thread. The method of making the carbon is to take a thread or cord of fibrous asbestos and soak it in a saturated solution of pure sugar, by preference a saturated solution made from the crystals of pure cane-sugar, and then thoroughly dry the asbestos thread or cord so as to deposit a film or coating of pure sugar upon it. This process of soaking may be continued till a film or coating of sugar is deposited on the asbestos thread or cord of the thickness required. When dry, the sugar-coated asbestos thread or cord is dipped in naphtha, benzole, or other suitable hydro-carbon, and immediately set on fire, thereby carbonising the sugar, and this process may be repeated if necessary until the film or coating of sugar is completely converted into pure carbon; or the film or coating of sugar may be carbonised in any other suitable manner. This invention will produce a resistance necessary for the production of an incandescent electric light, and may be used in any form of incandescent electric lamp.

4854. "Production, storage, and utilisation of electricity for lighting or power purposes." JOHN BANTING ROGERS. Dated November 5. 2d. The object of this invention is improved means and apparatus or appliances connected with the production, the storage, and utilisation of electricity for lighting or power purposes. The inventor mounts upon or in connection with an axle or the running wheels of a railway truck, carriage, engine, or other vehicle, or by a small engine thereon, one or more dynamo-electric machines, and leads conducting wires therefrom for conveying the electric fluid to receivers or vessels of special construction, within which the fluid can be retained in given quantities and at such densities to be used therefrom for lighting the carriages as it is produced while the train is travelling, and also to continue the lighting for a given time while the train is standing still, such as when stopping at a station. The receiver, of which there can be more than one if desired, can be carried in the guard's break, or in some other portion of the train readily available to the conductor or guard, in order that he may connect and disconnect the necessary wires, or change the direction of the current, or to put one or other of the receivers in or out of action as desired. The receivers or storage vessels are composed of a rectangular shaped box open at top. Into this box is inserted another box, whose open end or side is lowermost, and resting or nearly so on the bottom of the outer box. The inner box is provided with racks or notched bars kept at the desired distance apart by stays or tie rods, and they have sheet lead (or other necessary absorber of electricity) arranged in undulating or zigzag order between the racks or notched bars, as to leave a clearance between every two folds or plys of lead. The outer box is kept charged with a salt or acid liquid, in which the inner box, the racks, and the folds or plys of lead are submerged. The racks and lead folds are in connection by conducting wires and adjustable appliances, and have also circuit wires leading to lamps arranged in the roofs or other portions of the carriages, the lamps being provided with carbons for the "arc," or arranged for the "incandescent" light.

4855. "Electric lamps." JOHN BANTING ROGERS. Dated November 5. 6d. The object of this Invention is, first, to arrange carbons that the "arc" or the "incandescent" light can be produced in the same lamp and by the same carbons at will, and so that the light may be changed from one to the other by a simple movement. Secondly. A special construction of lamp with two carbons disconnected from each other and capable of adjustment by weights, the carbons being each in contact with a non-combustible body, which also move. Thirdly. A special method of establishing and of breaking the circuit of suspended electric lamps on such lamps being raised and lowered, whereby the usual unsightly loose hanging conducting wires can be dispensed with. Fourthly. Fitting three carbons, two of them being held by a lower frame and one in an upper frame which rests upon the two lower ones, and capable of being shifted on to either of the lower ones, or both, or *vice versâ*. The two carbons may be arranged to the upper frame. These carbons may be increased in number if desired.

4866. "Voltaic or galvanic batteries." THEOPHILUS COAD. Dated November 7. 6d. Relates to the construction of a multiple carbon battery, the object being to obtain greater constancy and electromotive force (!!!) than hitherto, and also to provide improved means for filling and discharging the cells of galvanic batteries. In carrying out the invention the carbon electrode is formed of a number of plates of carbon, separated from one another by carbon distance pieces, the whole being connected together by carbon bolts and nuts; or the multiple carbon electrode may be formed by moulding or otherwise. By the employment of an electrode of this construction greater surface is obtained than hitherto. The inner or porous cell is furnished near the top thereof with a discharge tube or spout which passes through an opening provided for the purpose in the outer cell, or over the top of the outer cell. The said outer cell is also provided with a suitable discharge spout; a stopper for each spout being provided. The porous pot containing the carbon electrode is permanently hermetically sealed, a charging opening with stopper being provided, and the space between the porous pot and the outer cell is closed by a removable cover fitting liquid tight, and provided with a charging opening closed by a stopper.

4883. "Electro-pneumatic apparatus for winding and regulating clocks." MAURICE BAUER. (A communication by Charles Albert Mayrhofer and Willy Otto, both electric engineers, of Paris.) Dated November 8. 8d. The improved apparatus forming the present invention consists of the following arrangements:—1st. Of a well-constructed and strongly built clockwork forming the central clock. 2nd. Of an electric distributor, which at certain intervals, occasioned by the central clock, sends out into a number of electric conductors in various directions electric currents of short duration. 3rd. Of an electro-pneumatic relay for receiving the current arriving from the central clock, which relay may be placed at any required distance from the said central clock, and sets in motion a pneumatic apparatus in accordance with the electrical impulses received. 4th. Of what may be called a group normal clock, which is kept in corresponding time with the central clock by means of the pneumatic apparatus at the relay. 5th. Of the three-way air cock, which is opened and shut by the action of the group normal clock. 6th. Of ordinary clocks with going works, which are wound up and regulated by the compressed air immediately the three-way cock opens.

## 1882.

819. "Electric-lighting apparatus for railway trains, &c." S. PITT. (A communication from abroad by Eli T. Starr, of the City and County of Philadelphia.) Dated February 20. 8d. In an application filed by the inventor in the British Patent Office on or about the 21st day of December, 1881, is shown and described a practical method of and an organisation of mechanism or devices for producing lights useful upon railway trains and for other analogous purposes. In the said application is shown a dynamo-electric machine or mechanical generator of electricity connected by a driving connection with a revolving axle of one of the vehicles, so as to be driven by the motion of the train or vehicle to generate electric currents by which to charge a storage or secondary battery, whereby through suitable circuit connections under the control of the engineer the electric current is conducted to an electric lamp at the front of the engine, to produce an electric head light for the locomotive, and to an electric lamp at the rear of the train, to produce an electric light especially useful as a signal light. By means of the secondary battery the light is kept up during the stoppages of the train. An automatic circuit-breaker forms part of the circuit between the rear or signal light and the secondary battery, so that during the motion of the train said signal light will be a flash light, or in other words will be an intermittent light consisting of a continuous series of luminous electric flashes. By means of this signal light at the rear of the train organised to flash while the train is in motion, the engineer of an approaching train is enabled to tell whether the train bearing the signal is standing still or is in motion, and if in motion at what rate of speed it is moving. The object of the present invention more especially is to improve the system of electric lighting for railway trains or other moving carriages or vessels set forth in the said British application.

838. "Dynamo-electric machines." W. R. LAKE. (A communication from abroad by Bernard Lande, of New York.) Dated February 21. 6d. Relates to that class of machines for generating electric currents having a paramagnetic ring armature, around which an electric conductor is wound, and which is caused to revolve in magnetic fields, and comprises certain improvements in the paramagnetic ring, whereby it and the electric conductor wound thereon are kept at a moderate and safe temperature, and certain improvements in the construction of the frame and inducing electro-magnets and their poles, whereby the machine is rendered very compact and efficient, and simple and economical in construction.

GREAT NORTHERN TELEGRAPH COMPANY.—The Company's Amoy-Shanghai Cable having been repaired, telegrams for all stations in China and Japan are again accepted for transmission by this company's route. The daily courier service between Amoy and Foochow, which has been suspended during the winter season, has been re-established from the 1st June.

THE BRAZILIAN SUBMARINE TELEGRAPH COMPANY (LIMITED).—The directors have declared an interim dividend of 3s. per share, or 6 per cent. per annum, free of income-tax, for the quarter ended March 31st last, and payable on the 24th inst. The books of this company will be closed from Saturday, the 17th, to Friday, the 23rd inst., both days inclusive.

APPLICATION has been made to the Stock Exchange Committee to appoint a special settling day in and to allow the following securities to be quoted in the official list:—The Swan United Electric Light Company (Limited) shares, the Indian and Oriental Electrical Storage and Works Company (Limited) shares, South-Eastern (Brush) Electric Light and Power Company (Limited) shares, Brush Midland Electric Light and Power Company (Limited) shares, and the Pilsen, Joel, and General Electric Light Company (Limited) shares.

## LATEST QUOTATIONS.

| Authorised Issue. | Share. | Name. | Paid. | Closing Quotations. June 7. | Business Done. |
|---|---|---|---|---|---|
| | | **ELECTRIC LIGHT.** | | | |
| 40,000 | 10 | Anglo-American Brush Co. | 4 | 20 - 21 | 20⅞ ⅞ 20¾ 20½. |
| | | Do. Do. | 10 | ⅝ - 1⅛ | 1.1⅛.01⅝.1 |
| 150,000 | 1 | Electric Light and Power Generator Co. | 1 | .. | |
| 24,980 | 5 | Hammond Electric Light & Power Supply Co. | 2½ | 11 - 12 | 12.11¼ |
| | | **TELEGRAPHS.** | | | |
| 2,116,400*l.* | Stk. | Anglo-American, Limited | 100 | 53 - 54 | 53½ |
| 2,441,800*l.* | Stk. | Do. Preferred (Def'd. receiving no div. until) | 100 | 85 -86 | 86.5½.4.4.4.5* .4.5 |
| 2,441,800*l.* | Stk. | Do. Deferred (6 p. c. has been paid to Pref.) | 100 | 23 - 24 | 23¾ ½ |
| 130,000 | 10 | Brazilian Submarine, Limited | 10 | 11⅜ - 11½ | 11¼ |
| 16,000 | 10 | Cuba, Limited | 10 | 9 - 9½ | |
| 6,000 | 10 | Do. 10 per cent. Preference | 10 | 16 - 17 | |
| 13,000 | 10 | Direct Spanish, Limited | 9 | 6½ - 6⅝ | |
| 6,000 | 10 | Do. 10 per cent. Preference | 10 | 15½ 16½ | |
| 65,000 | 20 | Direct United States Cable, Limited, 1877 | 20 | 12½ - 12⅝ | 12⅝ ¼ |
| 100,000*l.* | 100 | Do. 6 per cent. Debenture, repayable 1884 | 100 | 101 -104 | |
| 380,000 | 10 | Eastern, Limited | 10 | 10¼ - 10⅜ | 10¼ .⅝ |
| 70,000 | 10 | Do. 6 per cent. Preference | 10 | 13 - 13½ | 13¼ .½ |
| 232,000*l.* | 100 | Do. 6 do. Debentures, repayable Oct. 1833 | 100 | 99 -102 | |
| 200,000*l.* | 100 | Do. 5 do. do. Aug. 1887 | 100 | 101 -104 | |
| 200,000*l.* | 100 | Do. 5 do. do. Aug. 1899 | 100 | 102 -107 | |
| 199,750 | 10 | Eastern Extension, Australasia & China, Limited | 10 | 11¼ - 11⅜ | 11⅜ |
| 320,000 | 100 | Do. 6 p. c. Debentures, repayable Feb. 1891 | 103 | 106 -110 | |
| 500,000 | 100 | Do. 5 p. c. (Australian Gov. Subsidy) Deb. 1900 | 100 | 103 -106 | |
| 140,000 | 100 | Do. do. registered, repayable 1900 | 100 | 103 -106 | |
| 100,000*l.* | 100 | Do. 5 per cent. Debenture, 1890 | 100 | 101 -104 | |
| 254,300*l.* | 100 | Eastern and South African Limited 5 per cent. (Mort. Deb. Registered redeemable 1 Jan. 1900) | 100 | 102 -105 | |
| 345,700*l.* | 100 | Do. do. To Bearer | 100 | 102 -105 | |
| 22,050 | 10 | German Union Telegraph and Trust, Limited | 10 | 9½ - 10 | |
| 163,390 | 10 | Globe Telegraph and Trust, Limited | 10 | 6⅝ - 6¾ | 6⅞.⅝.⅞.¾.¾ |
| 163,209 | 10 | Do. 6 per cent. Preference | 10 | 12½ - 12⅝ | 12⅝ ¼ |
| 125,000 | 10 | Great Northern | 10 | 12⅝ - 13¼ | 13¼ ¼ |
| 100,000*l.* | 100 | Do. 5 per cent. Debentures | 100 | 102 -105 | |
| 31,200 | 10 | India-Rubber, Gutta-Percha and Telegraph Works | 10 | 26 - 27 | 26¾ ¼ |
| 100,000 | 100 | Do. 6 per cent. Debentures, 1885 | 100 | 101 -105 | |
| 17,000 | 25 | Indo-European, Limited | 25 | 23 - 25 | |
| 38,148 | 10 | London Platino-Brazilian, Limited | 10 | 4½ - 5 | xd. |
| 12,060 | 10 | Mediterranean Extension, Limited | 10 | 2 - 2½ | |
| 8,200 | 10 | Do. 8 per cent. Preference | 10 | 8½ - 9 | |
| 9,000 | 8 | Reuter's, Limited | 8 | 12⅝ - 13¼ | |
| 280,000 | Stk. | Submarine | 100 | 265 -275 | |
| 58,225 | 1 | Do. Scrip | 1 | 2⅜ - 2⅝ | |
| 4,200 | Cert. | Submarine Cables Trust | 100 | 102 -105 | |
| 37,350 | 12 | Telegraph Construction and Maintenance | 12 | 29½ - 30½ | |
| 150,000 | 100 | Do. 6 per cent. Bonds, 1884 | 100 | 102 -105 | 105 |
| 186,750 | 5 | Do. 2nd Bonus Trust Cert. | 5 | 1⅛ - 1⅜ | |
| 30,000 | 10 | West Coast of America, Limited | 10 | 5¼ - 5⅝ | |
| 150,000 | 100 | Do. 8 per cent. Debentures | .. | .. .. | |
| 69,910 | 20 | Western and Brazilian, Limited | 20 | 7¼ - 7⅜ | 7¼ |
| 200,000*l.* | 100 | Do. 6 per cent. Debentures "A" 1910 | 100 | 107 -112 | |
| 2,500 | 100 | Do. 6 p.c. Mort. Deb. series B of '80. red. Feb., 1910 | 100 | 99 -102 | |
| 1,500 | $1,000 | Western Union of U. S. 7 p.c. 1 Mort. (Building) Bds. | $1,000 | 121 -126 | |
| 1,030,000*l.* | 100 | Do. 6 per cent. Sterling Bonds | 100 | 102 -105 | |
| 88,321 | 10 | West India and Panama, Limited | 10 | 1⅝ - 2 | 1⅝ |
| 34,563 | 10 | Do. 6 per cent. 1st Preference | 10 | 8½ - 9 | |
| 4,669 | 10 | Do. 6 do. 2nd do. | 10 | 6½ - 7¼ | |
| | | **TELEPHONES.** | | | |
| 154,165 | 1 | Con. Telephone & Maintenance, Ld. Nos. 1 to 154,165 | 1 | 1⅝ - 1⅞ | ⅝ |
| 200,000 | 1 | Oriental Telephone Co. | ¼ | ⅛ - ⅜ | |
| 100,000 | 5 | United Telephone Co. | 5 | 14⅞ - 14¾ | 14⅞.¾.¾ |

* Exceptional amount at special price.

## TRAFFIC RECEIPTS.

The Brazilian Submarine Telegraph Company. The traffic receipts for the week ended June 2nd were £3.390. and Western and Brazilian for the same term £2.441, after deducting the "fifth" of the gross receipts payable to the London Platino-Brazilian Company.

The Cuba Submarine Telegraph Company, Limited. The number of messages passing over the lines of this company during the month of May was 3.408, estimated to produce £3,300, against 2,979 messages, producing £3,021, in the corresponding month of last year.

The Eastern Telegraph Company. The traffic receipts for the month of May amounted to £52,704, and to £43,872 in the corresponding period in 1881.

The Eastern Extension Telegraph Company. The traffic receipts for the month of May amounted to £33,087, and to £29,523 for the corresponding period of 1881.

The Great Northern Telegraph Company. The traffic receipts in May, 1832, were £21,720, from the 1st January to 31st May, 1882, £93.000. and for corresponding months of 1881, £93.172. and 1880, £85,603.

The Western and Brazilian Telegraph Company, Limited. The traffic receipts for the week ending May 26th, 1882, were £8,550, and for the week ending June 2nd, 1882. £2.441. both after deducting the "fifth" of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited.

The West India and Panama Telegraph Company, Limited. The traffic receipts for the half-month ended the 31st May are £3.305, as compared with £2.759 in the corresponding period of 1881.